HAMILTON 1987

AIR QUALITY SURVEY IN THE VICINITY OF COLUMBIAN CHEMICAL, CANRON, DOMTAR, STELCO, DOFASCO AND THE GENERAL INDUSTRIAL AREA OF HAMILTON, ONTARIO SEPTEMBER AND OCTOBER 1987

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Jim Bradley
Minister

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SEPTEMBER AND OCTOBER 1987

Ronald Bell
Air Resources Branch

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EXECUTIVE SUMMARY

At the request of the West Central Region, Mobile Air Monitoring Units #1 and #2 of the Air Resources Branch performed an air quality survey in the vicinity of Columbian Chemical, Canron, Domtar, Stelco, Dofasco and the general industrial sector of Hamilton during September and October of 1987. The main aims of this survey were to (1) investigate the air quality downwind of these industries, (2) establish a general air quality data set for the sector and (3) compare the results with similar studies conducted in 1985 and 1986.

From the data acquired during the 1987 survey, carbon monoxide, oxides of nitrogen, total reduced sulphur compounds, some low-boiling volatile aromatic organic compounds and naphthalene continue to present some potential environmental concerns in the Hamilton industrial sector. Maximum half-hour average ground level concentrations of carbon monoxide ranged up to 6.8 ppm (parts per million); oxides of nitrogen, up to 0.63 ppm; total reduced sulphur compounds, up to 0.105 ppm; volatile aromatic organic compounds, up to 990 ug/m^3 (micrograms per cubic metre); and naphthalene, up to 61 ug/m^3. Apart from naphthalene and total reduced sulphur compounds, these gaseous contaminants were found to occur commonly throughout most of the lower Hamilton industrial sector. Higher concentrations of naphthalene and total reduced sulphur compounds were measured downwind of the Domtar (Cassidy Works) tar plant on Strathearne Avenue. A comparison was made between the 1987, 1986 and 1985 air quality data sets and except for significant reductions in naphthalene concentrations downwind of Domtar, very few differences were noted.

Except for naphthalene, none of the measured gaseous contaminant concentrations were found to be in excess of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines. (The Ministry's Air Quality Provisional Guideline for naphthalene is 36 ug/m^3 for an allowable upper-limit half-hour average concentration.) Depending on the weather conditions and plant schedules, rotten-egg (attributed to total reduced sulphur compounds), sweet organic (low-boiling aromatic volatile organic compounds) or coal-tar (naphthalene and indan) type odours were still detected in this area of Hamilton.

Table of Abbreviations

CH_4	methane
CO	carbon monoxide
GC	gas chromatograph
i.e.	that is
km/hr	kilometres per hour
MAMU	Mobile Air Monitoring Unit
na.	not available
nd.	not detected
NO	nitric oxide
NO_x	oxides of nitrogen
NO_2	nitrogen dioxide
O_3	ozone
ppm	parts per million
SO_2	sulphur dioxide
TRS	total reduced sulphur compounds
THC	total hydrocarbon compounds
TH-M	non-methane hydrocarbons
ug/m^3	micrograms per cubic metre
VOC(s)	volatile organic compound(s)

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1.0 Background and Introduction

During the fall of 1985 and 1986, Mobile Air Monitoring Units #1 and #2 (MAMU#1 and #2) of the Air Resources Branch conducted air quality surveys in the downtown and industrial sectors of Hamilton. The main aims of these surveys were to characterize the air quality in these areas and if possible, investigate the air quality in the vicinity of several industries north of Burlington Street, namely; the Domtar (Cassidy Works) tar plant, Columbian Chemical, and the Stelco and Dofasco steel mills. The results of these two surveys were released as Ministry reports ARB-219-85-AQM, ARB-84-86-AQM and ARB-144-87-AQM.

During the 1985 air quality survey, significant concentrations of total reduced sulphur compounds and volatile organic compounds were detected downwind of Domtar. The maximum half-hour average ground level concentration of TRS measured at that time was 0.10 ppm and the total organic concentrations ranged up to 1650 ug/m^3. The more dominant VOCs were benzene, toluene and xylenes with reported maximum half-hour average concentrations of 330, 150 and 164 ug/m^3 respectively. Naphthalene was identified in some of the collected VOC samples but could not be quantified. For the other industries: significant concentrations of TRS and NO_x (maximum half-hour average concentrations of 0.027 and 0.24 ppm respectively) were measured downwind of Dofasco; significant concentrations of TRS, SO_2, and NO_x (maximum half-hour average concentrations of 0.087, 0.15 and 0.22 ppm respectively) were measured downwind of Stelco; whereas low concentrations of these gaseous contaminants were measured downwind of Columbian Chemical. For the VOC sampling programs carried out downwind of these last three companies, the total organic concentrations ranged to only 500 ug/m^3 with individual VOC concentrations less than 50 ug/m^3. In summary, from the air quality data collected during the 1985 study, none of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded for any of the measured gaseous contaminants.

From the air quality data acquired during the 1986 survey, NO_x, TRS and naphthalene were again found to be potential environmental problems. The Domtar tar plant was determined to be a source of TRS, aromatic VOCs, some chlorinated alkanes, indan and naphthalene as respective maximum half-hour average concentrations were found to be 0.120 ppm, 1037 ug/m^3, 516 ug/m^3, 141 ug/m^{3}and 330 ug/m^3. For naphthalene, the Ministry adopted a half-hour Provisional Guideline of 36 ug/m^3 in April of 1987; five months after the completion of the 1986 survey. Good atmospheric dispersion conditions existed while monitoring downwind of Dofasco and very little odour was detected. The maximum half-hour average concentrations of CO, TRS and NO_x were 1.9, 0.006 and 0.22 ppm respectively. Low VOC concentrations were detected as the total

organic concentrations were less than 160 ug/m^3 and individual organic concentrations were all less than 25 ug/m^3. Stelco was determined to be a major source of NO_x and TRS as the maximum half-hour average concentrations measured for these contaminants were 0.47 and 0.010 ppm respectively. However, low VOC concentrations were detected downwind of this steel plant as none were in excess of 30 ug/m^3. During the downwind monitoring of Columbian Chemical, the maximum half-hour average concentrations of CO, TRS and NO_x were 1.1, 0.006 and 0.07 ppm respectively. As for the VOCs, the individual concentrations were less 35 ug/m^3 and the maximum total organic concentration was 275 ug/m^3. As with the 1985 study, none of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded for any of the measured or detected gaseous contaminants in 1986.

All of these aforementioned industries have on-going abatement programs and as a result, the general air quality in the downtown and industrial sectors of Hamilton has improved over the years. To confirm this, the West Central Region again requested a similar air quality survey to be conducted in the industrial area of Hamilton during the fall of 1987 (Figure 1). The main aims of this survey were to: (1) investigate the air quality downwind of the selected industries north of Burlington Street, (2) establish a general air quality data set for this sector and (3) compare the results with similar studies conducted in 1985 and 1986.

2.0 The Monitoring Program

The mobile air monitoring units used in this survey contained a variety of analyzers that enabled screening of the ambient air for 138 different volatile organic compounds and 10 different (mainly inorganic) common contaminants.

The most versatile analyzer of each monitoring unit was the dual capillary column gas chromatographic system which was used for the detection, identification and quantification of VOCs. To detect individual VOCs at the 1 ug/m^3 concentration level, ambient air was drawn through a trace organic preconcentrator unit for a set period of time, usually a half-hour or a one-hour duration. In the preconcentrator, the organics were adsorbed onto a Carbotrap-Spherocarb cartridge and then thermally desorbed and prefocused onto a nickel loop cooled to -195°C with liquid nitrogen. The prefocused organics were then flash vapourized and injected simultaneously onto the heads of two 25 metre capillary columns (OV-1 and SE-54) where the individual organics were separated. The eluted organics were then detected by flame ionization detectors. Positive identification of the eluted volatile organic compounds was assisted by a computer which compared and correlated the results with a library of retention indices which were established from prior calibration tests.

Each monitoring unit also housed a complete ground-based meteorological station which continuously recorded wind direction and speed, ambient temperature, humidity, solar radiation and barometric pressure data.

A more detailed description of the specific monitoring capabilities of each monitoring unit is listed in Table 1 and a list of the gaseous contaminants monitored together with applicable Ministry of the Environment Standards, Criteria, Guidelines and Provisional Guidelines are presented in Table 2.

The daily monitoring program consisted of performing calibration checks on all analyzers and then acquiring air quality data in the vicinity of the aforementioned industries whenever possible; usually, one monitoring unit would be placed downwind of the industry and the other, upwind. Frequent VOC samples were collected only when the operators felt that the monitoring units were at suitable locations (e.g. downwind of a plant). At other times (overnight or when the weather was unfavourable), a more limited VOC sampling program was followed.

As presented in Table 3, monitoring was conducted between September 28 and October 21, 1987. During this time, MAMUs #1 and #2 acquired 8 VOC samples and 11 hours of common contaminant data

during 2 monitoring periods in order to characterize the air quality in the vicinity of Columbian Chemical; 7 VOC samples and 14 hours of common contaminant data during 6 monitoring periods for the Canron foundry; 14 VOC samples and 26 hours of common contaminant data during 10 monitoring periods for the Domtar (Cassidy Works) tar plant; 3 VOC samples and 5 hours of common contaminant data during 3 monitoring periods for the Stelco and Dofasco steel mills; and 4 VOC samples and 19 hours of common contaminant data during 8 monitoring periods for general air quality during calm and poor atmospheric dispersion conditions and 1 VOC sample together with almost 622 hours of common contaminant data during 25 monitoring periods for overnight and other long-term monitoring (Table 4).

3.0 Discussion of Results

3.1 Air Quality in the Vicinity of Columbian Chemical

As indicated in Table 4, air quality monitoring in the vicinity of Columbian Chemical was only conducted on September 29. It was an overcast day with brisk (up to 50 km/hr) westerly winds and rain was forecasted. Because of the winds, the Pier 24/25 site (MAMU#1) was downwind of Columbian Chemical and the J.I.Case site (MAMU#2) was upwind (Figure 1). Monitoring commenced at 09:55 hrs. Almost 6 hours of common contaminant data and 4 VOC samples were collected at Pier 24/25 and another 6 hours of common contaminant data and 4 VOC samples were collected at J.I.Case (Table 3).

At Pier 24/25, a slight non-sulphurous odour of industrial nature was noted and apart from carbon monoxide, low concentrations of the common contaminants were measured. The maximum half-hour average ground level concentrations of TH-M, CO, NO_x and TRS were 0.5, 12.4, 0.05 and 0.006 ppm respectively (A292D; Table 5). An average of only 19 different organics were detected in the VOC samples and the average total organic concentration was only 59 ug/m^3 with the alkanes and aromatics accounting for 66% (39 ug/m^3) and 32% (19 ug/m^3) of this total respectively (Tables 6 and 7). None of these data collected downwind of Columbian Chemical exceeded applicable Ministry Air Quality Criteria, Standards, Guidelines or Provisional Guidelines (Table 2).

At J.I. Case, the monitoring crew did not detect any significant odours. The winds were westerly but because of the escarpment, the winds had diminished to approximately 30 km/hr. Although this site was upwind of Columbian Chemical, it was also downwind of several other sources of the lower Hamilton industrial sector (Figure 1). Because of these factors, the concentrations measured at this site were slightly higher than those measured at Pier 24/25. The maximum half-hour average ground level concentrations of TH-M, CO, NO_x, TRS and SO_2 were 0.6, 0.6, 0.06, nd (not detected; i.e. less than 0.002 ppm) and 0.02 ppm respectively (B292U; Table 5). For the VOCs, an average of 21 different organics were detected in the 4 samples and the average total concentration was 104 ug/m^3. The alkane and aromatic fractions accounted for 41% (43 ug/m^3) and 50% (52 ug/m^3) of this total respectively (Tables 6 and 7).

During October of 1986, the maximum half-hour average ground level concentrations of CO, THC, TRS and NO_x measured downwind of Columbian Chemical were 1.1, 1.9, 0.006 and 0.07 ppm respectively. From the analyses of the 3 VOC samples acquired downwind of this plant, the average total organic concentration was 157 ug/m^3 (217, 100 and 155 ug/m^3) with the alkane and aromatic

fractions accounting for approximately 60 and 30% of these totals respectively (Report: ARB-144-87-AQM).

If one can compare the results from a single day of monitoring in 1987 to the air quality results obtained in 1986, the data appear to be similar. During both surveys, CO and the low-boiling alkanes were the dominant contaminants. As in 1986, the winds were brisk and very little, if any, contribution directly attributable to Columbian Chemical could be made with respect to the contaminants measured.

3.2 Air Quality in the Vicinity of Canron

As noted in Tables 3 and 4, monitoring in the vicinity of Canron was conducted on September 30 and October 1. Canron is composed of a Pipe Division and a foundry. Monitoring was conducted downwind of the Pipe Division; the suspected source of odour complaints. Both monitoring units participated and together, approximately 9 hours of common contaminant data and 3 VOC samples were acquired upwind and approximately 5 hours of common contaminant data and 4 VOC samples were acquired downwind of this plant.

It was overcast on September 30 and by 13:30 hrs, light rain was falling. By 15:30 hrs, the weather had deteriorated considerably and a severe weather warning was issued for the Hamilton area. The winds were northwest and brisk (35 to 40 km/hr) throughout most of the day and the ambient temperature was in the mid to high teens.

As directed by the Regional office, MAMU#2 moved onto plant property and commenced acquiring downwind air quality data at 11:00 hrs. The monitoring unit was somewhat shielded from the brisk winds by the buildings and as a result, the measured winds were less than 10 km/hr. Since MAMU#2 was located at the leeward side of the plant, mainly fugative emissions were monitored (B302; Table 3). A strong, non-sulphurous organic odour was present and from the 2.7 hours of common contaminant data and the 2 VOC samples, significant concentrations of TH-M, CO, NO_x and aromatics were measured. The maximum half-hour average concentrations of TH-M, CO and NO_x were 3.1, 11.2 and 0.13 ppm respectively (Table 5). From the analyses of the VOC samples, 70 and 59 different organics were identified and the total organic concentrations were 1432 and 782 ug/m^3 (Table 8). On the average, the alkanes, cycloalkanes, aromatics and chlorinated organics (i.e. the sum of the chlorinated alkanes, alkenes and aromatics) comprised 34% (494 and 259 ug/m^3), 7% (116 and 39 ug/m^3), 47% (653 and 386 ug/m^3) and 10% (136 and 77 ug/m^3) of these totals respectively. The more dominant organics were dichloromethane (44 and 20 ug/m^3), benzene (31 and 56 ug/m^3), toluene (69 and 53 ug/m^3), 2-methylheptane (45 and 12 ug/m^3), octane (68 and 20 ug/m^3), ethylbenzene (75 and 45 ug/m^3) and the xylenes (306 and 165 ug/m^3). The above aromatics could account for some of the odour but when compared to existing Ministry Air Quality Standards, Guidelines and Provisional Guidelines, these measured concentrations were very low (see Table 2).

After this monitoring and due to a slight veering of the wind, MAMU#2 moved to National Steel Car's employee parking lot, adjacent to Canron and approximately 0.3 km downwind of the major stacks. The winds continued to vary and the odour was intermittent. Commencing at 14:06 hrs, one hour of common contaminant data and another VOC sample were acquired (B303; Table 3). The same major

contaminants were measured as during B302 but because of the winds, the concentrations were less. The maximum half-hour average ground level concentrations of TH-M, CO and NO_x were 1.8, 3.4 and 0.07 ppm respectively. Fifty-four different organics were identified in the VOC sample and the total organic concentration was 595 ug/m^3 with the alkane, aromatic, cycloalkane and chlorinated fractions accounting for approximately 35%, 45%, 10% and 9% of this total respectively (Table 8). Again the more dominant organics were dichloromethane (12 ug/m^3), toluene (22 ug/m^3), 2-methylheptane (22 ug/m^3), octane (32 ug/m^3), ethylbenzene (35 ug/m^3) and the xylenes (134 ug/m^3).

Concurrent with the activities of MAMU#2, MAMU#1 carried out an upwind monitoring program. As directed by the Regional office, permission was granted and MAMU#1 was positioned on plant property near the centre of Canron's main parking lot, approximately 0.2 km upwind. The winds were northwesterly and brisk (35 to 40 km/hr). Although MAMU#1 was upwind of Canron, it was also downwind of several other companies and as a result, several different types of odour (including a strong sulphurous, tar-type odour) and a considerable amount of total suspended particulate matter were noted by the field staff. Commencing at 12:17 hrs, over 3 hours of common contaminant data and 2 half-hour VOC samples were acquired (A302; Table 3). The maximum half-hour average concentrations of the common contaminants TH-M, CO, NO_x and TRS measured at this site were 0.7, 0.9, 0.12 and 0.017 ppm respectively (Table 5). Low VOC concentrations were detected at this upwind site as the total organic concentrations were only 71 and 35 ug/m^3 and only 15 and 12 different organics were detected (Table 8).

After passage of severe weather overnight, there was a general clearing trend during the early morning of October 1. It was sunny and the winds remained westerly at 15 to 20 km/hr. The ambient temperature had dropped to the low teens. Initially, MAMU#1 was upwind of Canron and MAMU#2 was on plant property adjacent to and downwind. Monitoring commenced at approximately 11:00 hrs. At 13:30 hrs, MAMU#2 left the downwind site and moved to an upwind position near MAMU#1 (A012, B012 and B013; Table 3). During these times, 1.3 hours of common contaminant data and 1 VOC sample were acquired downwind of Canron and 6.2 hours of common contaminant data and 1 VOC sample were acquired upwind.

The maximum half-hour average ground level concentrations of TH-M, CO, NO_x, TRS and SO_2 measured downwind of Canron were 1.1, 3.7, 0.05, 0.003 and 0.01 ppm respectively (B012D; Table 5). Upwind of Canron (A012U and B013U), the maximum half-hour average concentrations ranged up to 1 ppm for TH-M; 1.8 ppm for CO; 0.07 ppm for NO_x; 0.008 ppm for TRS; and 0.01 ppm for SO_2. For the organics (Table 8), the total concentration detected downwind of Canron was 280 ug/m^3, whereas upwind, the total concentration was only 125 ug/m^3. Fifty different organics were detected in the downwind

sample with the alkanes and aromatics accounting for approximately 50% and 40% of the total concentration respectively. Thirty-four different organics were detected in the upwind sample and a similar alkane and aromatic composition resulted. The major VOCs detected downwind of Canron were some of the low-boiling alkanes (butane at 19 ug/m^3 and 2-methylbutane at 16 ug/m^3) and aromatics (toluene at 17 ug/m^3 and xylenes at 35 ug/m^3).

From these data, Canron appeared to be a source of CO and non-methane hydrocarbons (in particular some of the low-boiling alkanes and aromatics). For example, the average total organic concentration determined from the 4 VOC samples acquired downwind of Canron was 772 ug/m^3 whereas from the 3 upwind samples, the average was only 77 ug/m^3 (Table 6). None of the Ministry of the Environment's Air Quality Standards, Guidelines or Provisional Guidelines were exceeded for any of the measured gaseous contaminants. No previous air quality program had been carried out with respect to this designated source and as a result, no comparisons could be made with the 1987 data.

3.3 Air Quality in the Vicinity of Domtar

As noted in Tables 3 and 4, monitoring in the vicinity of Domtar was conducted on October 13, 14, 15 and 19. Ten different monitoring periods (5 upwind and 5 downwind) comprised this program during which 14 VOC samples and 26 hours of common contaminant data were acquired.

Only MAMU#2 participated in the monitoring program on October 13. This was a sunny day with the ambient temperature in the mid-teens and light easterly winds (5 to 10 km/hr). During the early afternoon, MAMU #2 moved to the parking lot of Stelco's #2 Rod Mill on Dobson Road. This site was directly downwind of Domtar and some aromatic odours were discernable. Commencing at 13:25 hrs, 2 VOC samples and just over 2 hours of common contaminant data were acquired (B132; Tables 3 and 9). Low concentrations of common contaminants were measured as the maximum half-hour average concentrations of TH-M, CO, NO_x, TRS and SO_2 were 0.9, 0.6, 0.12, 0.003 and 0.02 ppm respectively (Table 5). Although some aromatic odour was noted, the total organic concentrations of the 2 VOC samples were only 109 and 228 ug/m^3 (Table 9) with the alkane and aromatics comprising approximately 55 and 45% of these totals respectively.

A high pressure area dominated the weather over Hamilton on October 14. It was a bright sunny day with moderate (10 to 15 km/hr) southwesterly winds. During the morning, MAMU#2 moved to Strathearne Avenue and set up downwind of Domtar. Commencing at 10:20 hrs, 4 VOC samples and almost 6 hours of common contaminant data were acquired (B142; Tables 3 and 9). MAMU#1 was inoperative for most of the day but when the common contaminant analyzers were operational, it was positioned in Stelco's #2 Rod Mill parking lot, upwind of Domtar. Starting at 14:43 hrs, just over 1 hour of common contaminant data was acquired by this unit (A142; Table 3).

At the downwind site, a strong rotten-egg odour intermixed with an aromatic coal-tar type odour was noted by the field staff. As noted in Table 5, the maximum half-hour average ground level concentrations of TH-M, CO, NO_x, TRS and SO_2 were 2.3, 1.4, 0.06, 0.048 and 0.01 ppm respectively. The rotten-egg odour is clearly reflected by the significant TRS concentration. (Although not listed, the maximum 1-minute average concentration of TRS was 0.076 ppm. No Ministry Air Quality Guideline is available for TRS emissions from tar plants, although there is a TRS Provisional Guideline (0.027 ppm) for emissions from kraft pulp mills.) From the analyses of the 4 VOC samples, significant concentrations of organics were also detected downwind of this plant (Table 9). The total organic concentrations ranged from 591 to 952 ug/m^3 (an average of 777 ug/m^3) with the alkanes and aromatics comprising 11% (83 ug/m^3) and 85% (664 ug/m^3) of these totals respectively. The

more abundant VOCs were the aromatics and of these, benzene (average and maximum concentrations of 214 and 244ug/m^3), toluene (97 and 116 ug/m^3), ethylbenzene (36 and 42 ug/m^3) and the xylenes (87 and 107 ug/m^3) predominated. Other organics detected in significant concentrations were indan and naphthalene. The half-hour average concentrations of naphthalene ranged from 53 to 61 ug/m^3 (an average of 56 ug/m^3) and for indan, the range was 77 to 116 ug/m^3 (an average of 104 ug/m^3).

At the upwind site, no odours were detected and low concentrations of the common contaminants were measured. The maximum half-hour average concentrations of TH-M, CO, NO_x and TRS were 0.4, 0.6, 0.07 and 0.004 ppm respectively (A142; Table 5).

A warm front slowly pushed into the Hamilton area on October 15. The winds were southwesterly and light (10 to 15 km/hr). Initially, the sky condition was broken stratocumulus but deteoriated to overcast stratus with light rain by noon.

MAMU#1 moved to Strathearne Avenue, downwind of Domtar and commenced monitoring 11:15 hrs. Three VOC samples and 4.5 hours of common contaminant data were acquired (A152; Table 3). Meanwhile, MAMU#2 moved to Stelco's #2 Rod Mill parking lot, upwind of Domtar. The monitoring by MAMU#2 was run concurrant with MAMU#1 with 1 VOC sample and 4.4 hours of common contaminant data being acquired (B152; Table 3). At approximately 16:00 hrs, the monitoring units changed positions. MAMU#1 was now upwind where it acquired 1 VOC sample and 2 hours of common contaminant data (A153; Table 3). MAMU#2 was downwind and it acquired another VOC sample and 1.2 hours of common contaminant data (B153; Table 3). After 17:20 hrs, MAMU#2 returned to its overnight site at J.I. Case whereas MAMU#1 returned to Strathearne Avenue where it acquired another 1.9 hours of downwind data (B154 and A154). After 20:00 hrs, MAMU#1 returned to its overnight site at Pier 24/25.

From the downwind monitoring, significant concentrations of TRS and organics were measured. During monitoring periods A152, B153 and A154, the respective maximum half-hour average ground level concentrations of TH-M, CO, NO_x, TRS and SO_2 were 2.3, 1.8, 0.19, 0.105 and 0.02 ppm (Table 5). The 0.105 ppm of TRS was measured during A152 and the field staff noted a very strong rotten-egg odour coming from the direction of Domtar (the maximum 1-minute TRS average concentration was 0.201 ppm). From the analyses of the 4 VOC samples (3 from A152 and 1 from B153), elevated concentrations of VOCs were also detected (Table 9). The total organic concentrations ranged up to 1119 ug/m^3 (an average of 731 ug/m^3) with the alkanes comprising approximately 13% (an average of 95 ug/m^3) of these totals and the aromatics 85% (an average of 618 ug/m^3). The major organics were benzene, toluene, ethylbenzene, xylenes, indan and naphthalene with respective maximum half-hour concentrations of 299, 125, 43, 97, 384 and 16 ug/m^3.

From the upwind data, the CO, NO_x and SO_2 concentrations were very similar to those measured downwind. However, the TH-M, TRS and VOC results were much lower. During monitoring periods B152 and A153, the maximum half-hour average ground level concentrations of TH-M, CO, NO_x, TRS and SO_2 were 1.0, 3.1, 0.11, 0.004 and 0.02 ppm respectively (Table 5). The total organic concentrations determined from the 2 VOC samples were 112 and 76 ug/m^3 with an alkane contribution of approximately 70% and an aromatic contribution of approximately 20%. No indan or naphthalene were detected and the more abundant organics were the low-boiling alkanes propane and butane at 14 and 22 ug/m^3.

Although none of the common contaminants or organics were detected in concentrations greater than their repective Ministry Standards or Guidelines, the rotten-egg, sweet aromatic and coal-tar type odours were detected by the field staff throughout most of the day downwind of this plant. Light rain was present between 12:30 and 14:00 hrs and during this time, the highest concentrations of the aforementioned pollutants were measured.

The last day of monitoring in the vicinity of Domtar was October 19. This was a warm, hazy day with overcast conditions and light (less than 10 km/hr) southeasterly winds. Both monitoring units participated in the program with MAMU#1 located in the Stelco's #2 Rod Mill parking lot acquiring downwind data and MAMU#2 in Metal Recovery Ltd.'s parking lot on Strathearne Avenue acquiring upwind data. Monitoring at both sites commenced at approximately 14:30 hrs with 1 VOC sample and just over an hour of common contaminant data being collected downwind and 1 VOC sample and 1.7 hours of common contaminant data being collected upwind (A192 and B192; Table 3).

While at Stelco's #2 Rod Mill parking lot, the field staff detected odours coming from the direction of Domtar. The maximum half-hour average concentrations of TH-M, CO, NO_x and TRS measured at this site were 1.5, 2.0, 0.29 and 0.019 ppm respectively (A192; Table 5). While upwind, the respective maximum half-hour average concentrations were 6.8, 12.9, 0.38 and less than 0.002 ppm. The TH-M, CO and NO_x concentrations were higher upwind and this is perhaps due to the fact that the monitoring unit was parked along Strathearne and Burlington Streets (major highways) and close to Metal Recovery Limited's plant. In particular, it appeared that the NO_x results were greater than the Ministry half-hour Standard (0.25 ppm) but since a specific source could not be determined and the Air Quality Criterion for NO_2 was not exceeded, the Standard was not applicable. The NO_x concentrations were similar at both sites which lends credence to the statement that the entire industrial area was contributing to the NO_x. The opposite was true for TRS. Concentrations at the downwind site were greater than those measured upwind (TRS; 0.019 versus less than 0.002 ppm or not detected.).

Although odour was detected downwind of Domtar, the total organic concentration determined from the single VOC sample was only 261 ug/m^3 with equal contributions from the alkane and aromatic fractions. The major organics were the low-boiling alkanes and aromatics with individual concentrations all less than 35 ug/m^3. For indan and naphthalene, the concentrations were 41 and 1 ug/m^3 (A192; Table 9). From the upwind sample, the total organic concentration was slightly less at 206 ug/m^3 with the alkanes accounting for approximately 64% of this total and the aromatics 27%. No indan nor naphthalene were detected and the more abundant organics were the low-boiling alkanes with individual concentrations all less than 30 ug/m^3 (B192; Table 9).

Excluding TRS, the Ministry has applicable half-hour Air Quality Standards for the following common contaminants: CO (5 ppm); NO_x (0.25 ppm); and SO_2 (0.30 ppm). For the major VOCs detected during this survey, the Ministry has applicable half-hour Air Quality Standards, Guidelines or Provisional Guidelines for benzene (10,000 ug/m^3), toluene (2,000 ug/m^3), ethylbenzene (4,000 ug/m^3), xylenes (2,300 ug/m^3), carbon tetrachloride (1,800 ug/m^3) and naphthalene (36 ug/m^3) (Table 2).

From this monitoring program, significant concentrations of TRS and naphthalene were measured downwind of Domtar. In particular on October 14, the concentrations of naphthalene were in excess of the applicable Provisional Guideline. From the 11 downwind VOC samples, an average of 34 different organics were detected. The average total organic concentration was 603 ug/m^3 with the alkanes and aromatics accounting for 15 and 82% of this total respectively. An average of 27 different organics were detected in the 3 upwind samples and the average total concentration was only 132 ug/m^3 (Table 6).

During similar surveys conducted in 1986 and 1985 (ARB-144-87-AQM and ARB-219-85-AQM), the maximum half-hour average ground level concentrations of TRS detected downwind of Domtar were 0.12 and 0.10 ppm. During the 1987 study, the maximum half-hour TRS concentration was 0.11 ppm. From the analyses of 17 VOC samples collected during the 1985 study, the average total organic concentration was 700 ug/m^3. In 1986, the average concentration (from 12 VOC samples) was approximately 800 ug/m^3 and during the 1987 study, the average concentration (from 11 VOC samples) was approximately 600 ug/m^3. In 1985, the alkane, aromatic and chlorinated fractions accounted for 23, 69 and 5% respectively of the total organic concentrations. In 1986, these fractional percentages were 13, 74 and 12% and in 1987, they were 15, 82 and 2%. Naphthalene was identified in the VOC samples acquired during the 1985 study but could not be quantified. In 1986, half-hour average concentrations of naphthalene ranging up to 330 ug/m^3 were detected. In April of 1987, the Ministry adopted its half-hour

Provisional Guideline of 36 ug/m^3 for naphthalene. During the 1987 survey, half-hour average concentrations of naphthalene ranging up to 61 ug/m^3 were detected downwind of Domtar. In 1986, the maximum half-hour average indan concentration was 141 ug/m^3 whereas in 1987, it was 384 ug/m^3.

The concentrations of total reduced sulphur compounds and volatile organic compounds (in general) measured downwind of Domtar appear to have remained similar throughout these three studies. However concentrations of naphthalene seem to have decreased in 1987 whereas indan appears to have increased. In summary, Domtar may still be considered a source of rotten-egg (TRS), sweet-aromatic (VOCs) and coal-tar (naphthalene and indan) type odours.

3.4 Air Quality in the Vicinity of Stelco and Dofasco

This monitoring program was conducted on October 20 and 21. Only MAMU#1 participated and 3 VOC samples and 5 hours of common contaminant data were acquired.

On October 20, the winds were light and northeasterly. It was overcast and the ambient temperature was in the low teens. At noon, MAMU#1 moved to the J.I. Case shoreline site. This site was downwind of Stelco but no distinct odours were detected. At 12:05 hrs, monitoring commenced with 2 half-hour VOC samples and just over 2 hours of common contaminant data being collected (A203; Table 3). At 12:20 hrs, a slight 'coal-tar' type odour was detected but due to the light and variable winds, the odour was intermittent and the exact source direction could not be determined. At 13:50 hrs, light rain started and by 14:15 hrs, the winds had backed to the northnortheast and increased to 20 km/hr. For the common contaminants, the maximum half-hour average concentrations of TH-M, CO, NO_x and TRS measured during this period were 1.4, 1.2, 0.14 and 0.013 ppm respectively (Table 5). For the two VOC samples, only 15 and 16 different organics were detected and the total organic concentrations were 127 and 76 ug/m^3.

The winds remained light northeasterly overnight and by 09:00 hrs on October 21, light rain had started. Shortly after 10:00 hrs, MAMU#1 moved to the corner of Industrial and Ottawa Streets; a site downwind of Dofasco. The winds were light and it was cold (less than 10°C). Monitoring commenced at 10:40 hrs (A212; Table 3) and by 11:30 hrs, the rain had become heavy. Because of the light winds and heavy rain, no VOC samples were collected. The maximum half-hour average concentrations of the common contaminants TH-M, CO, NO_x and TRS were 0.9, 3.2, 0.27 and 0.006 ppm respectively (Table 5).

Some light snow started just after 12:00 hrs and at 12:30 hrs, the winds were light and southerly. Because of the wind shift, the site (Industrial and Ottawa Streets) was now upwind of Stelco. Monitoring period A212 was halted and another (A213) started with one hour of common contaminant data and 1 VOC cartridge being acquired (Table 3). These data were thought to be upwind measurements but due to the light and highly variable winds, were more apt to be indicative of traffic along Industrial Drive under poor atmospheric dispersion conditions. The maximum half-hour average concentrations of TH-M, CO, NO_x and TRS were 1.0, 3.6, 0.32 and 0.005 ppm respectively (Table 5). Relatively high organic concentrations were detected as the total organic concentration was 546 ug/m^3 with the alkane and aromatic components being 294 and 168 ug/m^3 respectively (Table 10). No naphthalene was detected and the major organics were the low-boiling alkanes (propane, 2-methylbutane, butane, hexane, etc.) and aromatics (benzene,

toluene, xylenes, etc.) whose individual concentrations were all less than 50 ug/m^3.

Although significant concentrations of CO and NO_x were measured during these 2 days, none of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded for any of the detected contaminants.

During the 1986 survey, significant concentrations of CO and NO_x were measured downwind of Stelco (ARB-144-87-AQM). The maximum half-hour average concentrations for the common contaminants CO, THC, TRS and NO_x were 2.4, 2.1, 0.01 and 0.47 ppm respectively. For NO_2, its maximum half-hour average concentration was 0.16 ppm. For the VOCs detected in 1986, the total organic concentrations ranged up to 354 ug/m^3 with the alkanes and aromatics accounting for approximately 50% and 40% of the totals respectively. These results were also obtained from only 2 days of monitoring. If one could compare these results with the 1987 survey results, it appears that very little difference exists between the 2 data sets. A general air quality assessment should not be made from 2 days of monitoring each year. All that could be stated is that worse-case, downwind monitoring was undertaken each year and that the results appear to be similar. The higher NO_x and CO concentrations appear to occur commonly throughout the lower Hamilton industrial area and no clear source(s) could be determined.

3.5 General Air Quality - Poor Weather Conditions

During poor weather conditions (i.e. heavy rain, overcast, calm or light variable winds, inversions and other poor atmospheric dispersion conditions, etc.) of October 2, 7, 16 and 20 when no specific source or sources could be determined, a general air quality data set was acquired. Eight monitoring periods comprised this program during which 19 hours of common contaminant data and 5 VOC samples were acquired (Tables 3 and 4).

It was overcast and raining heavily (visibility often less than 1 km) during the morning of October 2. The winds were westerly and brisk (50 to 60 km/hr). MAMU#1 was at the Pier 24/25 shoreline site and after the morning calibrations, a short monitoring program was started. Just over 3 hours of common contaminant data were acquired (A021; Table 3) and since no strong odours were detected, no VOC samples were collected. Low concentrations were measured as the maximum half-hour average concentrations of TH-M, CO, NO_x and TRS were 0.9, 0.4, 0.05 and 0.008 ppm respectively (Table 5).

The same type of weather conditions existed on October 7. It was overcast and raining; the winds were westerly at 20 to 30 km/hr; and the ambient temperature was below 10°C. MAMU#1 was at the Pier 24/25 site and again no odours were detected. After the morning calibrations, another short monitoring program for only the common contaminants was undertaken (A072; Table 3). Low levels were measured as the maximum half-hour average concentrations of TH-M, CO and NO_x were 0.8, 1.8 and 0.09 ppm respectively (Table 5).

An inversion was present on October 16. It was calm, cloudy and cool. The ambient temperature was approximately 10°C; visibility was less than 1 km; and at 11:00 hrs, the Hamilton Air Pollution Index was 31. During the morning, MAMU#1 was at the Pier 24/25 site and MAMU#2 was at the J.I. Case site.

Commencing at 08:45 hrs, MAMU#1 collected almost an hour of common contaminant data (A161; Table 3). The maximum half-hour average concentrations of TH-M, CO, NO_x and TRS were 1.4, 3.1, 0.63 and 0.007 ppm respectively (Table 5).

From 10:30 to 13:00 hrs, the winds became light easterly. MAMU#1 remained at the Pier 24/25 site and collected another 2.4 hours of common contaminant data (A163). The respective maximum half-hour average concentrations of the common contaminants TH-M, CO, NO_x and TRS were 1.4, 2.3, 0.50 and 0.005 (Table 5). Under the easterly winds, significant concentrations of CO and NO_x were measured (the major component of the oxides of nitrogen was NO and although not listed, its maximum half-hour average concentration was 0.34 ppm). The source of the monitored contaminants was thought to be vehicular traffic along the Queen Elizabeth Way. In order to

verify this source assessment, a VOC sample was also collected. From its analysis, the total organic concentration was determined to be 417 ug/m^3 with the alkane and aromatic fractions accounting for 69% (283 ug/m^3) and 24% (100 ug/m^3) of the total respectively (Table 10). The higher percentage alkane contribution (especially the low-boilers; propane through hexane ranging up to 54 ug/m^3) is indicative of vehicular emissions.

Starting at 11:00 hrs on this same day, MAMU#2 undertook a short monitoring program at the J.I. Case site during which 1 VOC sample and 1.7 hours of common contaminant data were acquired (B162; Table 3). The winds were also light during this period but due to the sheltering effect of the escarpment, the direction was westerly (rather than easterly as measured at Pier 24/25). Some intermittent sulphurous odour was noted but in general, the odour was characteristic of vehicular emissions. For the common contaminants TH-M, CO, NO_x, TRS and SO_2, the respective measured maximum half-hour average concentrations were 1.7, 2.4, 0.14, 0.012 and 0.05 ppm (Table 5). From the analyses of the single VOC sample (Table 10), 54 different organics were detected and the total organic concentration was 467 ug/m^3. Of this total, the alkane and aromatic fractions comprised 54% (250 ug/m^3) and 32% (151 ug/m^3) respectively. Again the more dominant organics were the low-boiling alkanes (propane through hexane) and aromatics (benzene, toluene and xylenes).

At 13:30 hrs, MAMU#1 moved to Sam Lawrence Park near Concession and Wellington Streets. Commencing at 14:05 hrs, 1 hour of common contaminant data and 1 VOC sample were acquired (A164; Table 3). Under very light winds, the maximum half-hour average concentrations of TH-M, CO, NO_x and TRS were determined to be 1.8, 3.1, 0.49 and 0.011 ppm respectively. Although not listed, the dominant oxides of nitrogen component was again NO and its maximum half-hour average concentration was 0.29 ppm. From the analysis of the VOC sample, 43 different organics were identified and the total organic concentration was 627 ug/m^3 (Table 10). The alkanes accounted for 62% (388 ug/m^3) and the aromatics 30% (191 ug/m^3) of this total. The low-boiling alkanes (propane through hexane) were again the major organics but the individual concentrations were all less than 80 ug/m^3. As a result of the elevated concentrations of CO, NO and low-boiling alkanes, the major source in this area was also deemed to be vehicular traffic.

Also at 13:30 hrs, MAMU#2 left the J.I. Case site and moved to McMaster University. Here in the west end of the lower city, monitoring was started at 15:00 hrs with 1 VOC sample and just over 1 hour of common contaminant data being acquired (B163; Table 3). The winds were still very light and easterly. From this monitoring program, low concentrations for the common contaminants were measured. The maximum half-hour average concentrations of TH-M, CO, NO_x and SO_2 were 1.1, 1.8, 0.05 and 0.02 ppm respectively

with over 80% of the NO_x being comprised of NO_2 (Table 5). From analysis of the VOC sample, 52 different organics were identified and the total organic concentration was 441 ug/m³. The alkanes and aromatics comprised 63% (278 ug/m³) and 20% (90 ug/m³) of this total respectively.

It was overcast during the morning of October 20 and the temperature was close to 10°C. Starting at 09:17 hrs, 2.2 hours of common contaminant data were acquired at the Pier 24/25 site. The maximum half-hour average concentrations of TH-M, CO, NO_x and TRS were 0.7, 1.2, 0.33 and 0.003 ppm respectively (A202; Table 3 and 5) with the oxides of nitrogen being composed of almost 90% NO. Monitoring was halted just before noon as the winds had become northerly at 10 to 20 km/hr.

The air quality results appear to be more indicative of the monitoring locations (i.e. near traffic routes; the general lower industrial sector of Hamilton; etc.) rather than the weather conditions. For example, the impact of vehicular emissions was very evident as the low-boiling alkanes, CO and NO were the more abundant gaseous contaminants measured at Pier 24/25 and at Sam Lawrence Park under very light winds. Some elevated concentrations of reduced sulphur compounds were also measured but the rotten-egg odour was intermittent and the source(s) could not be identified. Although elevated concentrations were measured (eg. CO and NO_2), none of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded.

3.6 General Air Quality - Overnight & Long-Term

The overnight and long-term monitoring sites were at Pier 24/25 on the West Service Road near the Skyway Bridge and at a storage area owned by J.I. Case near Sherman Avenue and Burlington Street (Figure 1). The monitoring units were usually on auxiliary electrical power and unattended at these sites and as a result, only the common contaminants were usually measured. Starting late afternoon on September 28, MAMU#1 undertook 12 different monitoring programs and acquired almost 300 hours of common contaminant data at the Pier 24/25 site. Likewise, MAMU#2 conducted 13 different monitoring programs and acquired almost 325 hours of common contaminant data at the J.I. Case site (Tables 3 and 4).

Since monitoring at these semi-permanent monitoring sites was usually unattended, only 1 VOC sample was collected. It was acquired during the afternoon of first survey day (September 28) at the J.I. Case site (B282; Table 3). September 28 was a bright sunny day with the afternoon ambient temperature in the high 20's and the winds were southwesterly at 10 to 15 km/hr. Good atmospheric dispersion existed and no odour was detected. The sample was acquired to check the proper operation of the GC system and to serve as a preliminary screen of the ambient air in the lower Hamilton industrial sector. Only 21 different organics were detected and the total organic concentration was only 130 ug/m^3 with essentially equal contributions from the alkane and aromatic fractions (71 and 59 ug/m^3 respectively; Table 10).

From the long-term common contaminant data set acquired at the Pier 24/25 site, the maximum daily one-hour average ground level concentrations of TH-M ranged from 0.5 to 1.6 ppm; for CO, from 0.5 to 6.3 ppm; for NO_2, from 0.04 to 0.08 ppm; and for TRS, from less than 0.002 ppm (not detected) to 0.076 ppm (Table 5).

Elevated concentrations of the common contaminants were measured during 4 of the 12 monitoring periods at the Pier 24/25 site. During the night of September 29, a cold front moved through Hamilton and the winds were westerly and brisk (25 to 35 km/hr). High CO and TRS concentrations (A293; 6.3 and 0.026 ppm respectively) were measured when the winds were from 290 degrees at 35 km/hr. Another frontal system pushed through Hamilton during the night of October 2 and once again, elevated concentrations of CO and TRS (A203; 5.0 and 0.034 ppm respectively) were measured when the winds were from 290 degrees and brisk (40 to 50 km/hr). The winds were brisk (25 to 35 km/hr) and westsouthwesterly throughout most of the night of October 14. At 01:00 hrs, the winds had dropped to less than 10 km/hr from 290 degrees. Elevated concentrations of CO and TRS (A143; 3.3 and 0.025 ppm) were again measured. On Friday October 16, a weekend monitoring program was undertaken - A165. During the morning of September 19, elevated concentrations of TRS

and CO were also measured. The winds were from the same direction (290 degrees) at 10 to 15 km/hr and the respective maximum one-hour average concentrations were 2.7 and 0.076 ppm.

For the common contaminant data acquired at the J.I. Case site, the maximum one-hour average ground level concentrations of TH-M ranged from 0.3 to 4.8 ppm; for CO, the range was from 0.8 to 3.3 ppm; for NO_2, the range was from 0.04 to 0.09 ppm; for TRS, the range was from less than 0.002 ppm (not detected) to 0.016 ppm; and for SO_2, the range was from less than 0.01 to 0.04 ppm (Table 5).

As with the data acquired at the Pier 24/25 site, elevated concentrations were also recorded during several of the monitoring periods at the J.I. Case site. It was a very calm night on October 12 and the winds were nominally westerly at 2 to 5 km/hr. An overnight monitoring program was started at 17:23 hrs and elevated concentrations of TH-M and CO were measured during the following morning between 07:30 and 09:30 hrs. The maximum one-hour average concentrations of TH-M and CO measured at this time were 4.8 and 3.3 ppm respectively (B121; Table 5). The most plausible source of these two contaminants was deemed to be the morning rush-hour traffic along Burlington Street. A weak nocturnal inversion was present during the night of October 15. The winds were calm and during the early morning, elevated concentrations of TH-M (3.5 ppm) and CO (2.3 ppm) were again measured (B154). Again the most plausible source was thought to be vehicular emissions. Another nocturnal inversion was present during the early morning of October 17. The winds were calm throughout the entire night and the respective maximum one-hour average concentrations of TH-M, CO and TRS were 3.0, 3.3 and 0.010 ppm (B164). During the early evening of September 19, the winds were easterly at 10 to 15 km/hr and a maximum one-hour average concentration of 0.016 ppm was measured for TRS.

If one could compare these 2 data sets, it would appear that in general, higher concentrations of non-methane hydrocarbons were measured at J.I. Case; higher concentrations of CO and TRS were measured at Pier 24/25; and the concentrations of NO_2 and SO_2 were low and similar at both sites.

In 1986, 99 hours of common contaminant data and 7 half-hour VOC samples were acquired during the overnight and other long-term monitoring periods. As in 1987, the weather was cool (often just above freezing) and the winds were brisk. For the common contaminants, the maximum one-hour average concentrations of CO ranged from 0.6 to 2.1 ppm; for THC, the range was from 1.4 to 3.9 ppm; for NO_2, the range was from 0.04 to 0.09 ppm; and for TRS, the range was from less than 0.002 ppm (not detected) to 0.024 ppm (ARB-114-87-AQM). For the VOCs, the average total organic concentration was 169 ug/m^3. Comparing this data with that obtained during 1987, very few differences were noted.

3.7 Mobile Scan - A Special Case

It was overcast and raining on October 2. The temperature was in the mid-teens and the winds were westerly at 20 to 30 km/hr. After a short morning monitoring program at Pier 24/25 (A021; Section 3.5), MAMU#1 undertook a 'slow mobile' traverse north along the West Service Road, east under the Skyway Bridge, south along Beach Boulevard and finally returning to Pier 24/25. Under westerly winds, this north/south traverse was perpendicular to the gaseous emissions originating from the industrial complex in the lower part of Hamilton. As stated in Section 3.5, the weather conditions were poor for monitoring any specific industries and in general, little if any odour was detected at Pier 24/25.

The traverse started at 13:09 hrs and travelling at 20 km/hr, ended at 13:40 hrs. The route was approximately 2 to 3 km downwind of the industrial complex and due to the relatively strong winds, considerable dispersion was evident. This dispersion was indicated by the fairly constant background of non-methane hydrocarbon concentrations measured throughout the entire traverse (Figure 2). The CO and THC analyzers are 'fast' responding instruments (less than 20 seconds) but it takes approximately 2 to 3 minutes before an air parcel can be analyzed by the TRS and NO_x analyzers. If one considers the 2 to 3 minute lag time for the TRS and NO_x measurements, 2 somewhat distinct plumes were outlined by the CO, TRS and NO_x measurements recorded during the north traverse. As further proof of these two plumes, the pattern was repeated (mirror imaged) during the south traverse. It was very difficult to identify the source(s) of these two plumes since no upwind mobile scans were undertaken. Although not listed, the maximum 1-minute average concentrations of CO, TH-M, TRS and NO_x measured during this exercise were 2.2, 0.9, 0.008 and 0.18 ppm respectively.

4.0 Summary

At the request of the West Central Region, Mobile Air Monitoring Units #1 and #2 of the Air Resources Branch performed an air quality survey in the vicinity of Columbian Chemical, Canron, Domtar, Stelco, Dofasco and the general lower industrial sector of Hamilton during September and October of 1987. The main aims of this survey were to: (1) investigate the air quality downwind of these industries, (2) establish a general air quality data set for this sector and if possible, (3) compare the results with similar studies conducted during 1985 and 1986.

Due to the weather conditions and other constraints, only one day of monitoring was possible in the vicinity of Columbian Chemical. As a result, a limited data set was acquired and if one compares the upwind and downwind measurements, very little impact, if any, would be directly attributable to emissions from this plant. The maximum half-hour average concentrations of the common contaminants TH-M, CO, NO_x and TRS measured downwind of this designated source were 0.5, 12.4, 0.05 and 0.006 ppm respectively. For the upwind measurements, the same respective maximum half-hour average concentrations were 0.6, 0.6, 0.06 and less than 0.002 ppm (not detected). Very little difference was also noted in the VOC samples as the total organic concentrations averaged 59 ug/m^3 (4 downwind samples) and 104 ug/m^3 (4 upwind samples). These total organic concentrations are considered to be low as the more dominant organics were the low-boiling alkanes and aromatics whose individual concentrations were all less than 20 ug/m^3. From these data, none of the applicable Ministry of the Environment's Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded. There was very little difference in the results from this single day of monitoring and those obtained during two days of monitoring in 1986.

The monitoring in the vicinity of Canron was conducted under the direction of the Regional office. The monitoring was mainly investigative and as a result, the majority of it was conducted on plant property. During the 2 days of monitoring by both monitoring units, a strong non-sulphurous, sweet aromatic odour was noted and an increase in CO, TH-M and VOCs concentrations were measured downwind of this plant. The maximum half-hour average concentrations of TH-M, CO, NO_x, TRS and SO_2 were 3.1, 11.2, 0.13, 0.007 and 0.05 ppm respectively. From analyses of 4 downwind VOC samples, an average of 58 different organics was detected. The average total organic concentration was 772 ug/m^3 with the alkane and aromatic fractions accounting for approximately 36 (275 ug/m^3) and 46% (355 ug/m^3) of these totals respectively. From analyses of 3 upwind VOC samples, an average of only 20 different organics was detected and the average total organic concentration was 77 ug/m^3. Although these measurements suggest that Canron was a source of CO

and TH-M (in particular some of the low-boiling alkanes and aromatics), none of these data were in excess of the applicable Ministry of the Environment's Air Quality Standards, Criteria, Guidelines or Provisional Guidelines.

Monitoring was conducted in the vicinity of the Domtar (Cassidy Works) tar plant on 4 different days. From this program, significant concentrations of naphthalene and TRS were measured downwind of this plant. From analyses of 4 downwind VOC samples acquired on October 14, the half-hour average concentrations of naphthalene ranged from 53 to 61 ug/m^3. (The applicable Ministry Air Quality Provisional Guideline for naphthalene is 36 ug/m^3.) In general for the 11 VOC samples acquired downwind of Domtar, an average of 34 different organics were detected and the average total organic concentration was 603 ug/m^3. Of this total, the average aromatic fraction was 492 ug/m^3 (over 80%). From the analyses of the 3 upwind VOC samples, an average of 27 different organics (no naphthalene) were detected and the average total concentration was only 132 ug/m^3. Although the majority of the organics detected downind of Domtar were aromatics, apart from naphthalene, none of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded for any of these other VOCs. Significant concentrations of TRS were measured downwind of this source during 3 separate monitoring periods as the maximum half-hour average concentrations were 0.048, 0.105 and 0.019 ppm. For NO_x, a maximum half-hour average concentration of 0.29 ppm was measured downwind of this plant. The Ministry NO_x Standard is 0.25 ppm. However this Standard was not applicable to these measurements since (a) no distinct source of NO_x could be determined (a half-hour average concentration of 0.38 ppm was measured upwind on the same day) and (b) the Ministry Air Quality Criterion of 0.20 ppm for an allowable one-hour average ground level concentration of NO_2 was not exceeded. Comparing these results with the 1985 and 1986 studies, the TRS and general VOC concentrations measured downwind of this tar plant appear to have remained essentially the same. However for the specific VOCs, less naphthalene was detected during the 1987 study (in 1986, half-hour average naphthalene concentrations ranged up to 330 ug/m^3). In summary, Domtar should still be considered a source of rotten-egg (TRS), sweet aromatic (VOCs) and coal-tar (naphthalene and indan) type odours.

During the 2 days of monitoring in the vicinity of Stelco and Dofasco, 3 VOC samples and approximately 5 hours of common contaminant data were acquired. During this time, significant concentrations of CO and NO_x (respective maximum half-hour average concentrations measured being 3.2 and 0.27 ppm) were measured. However Stelco and Dofasco were deemed not to be the major source of these contaminants as other measurements in the area revealed similar concentrations. As for the VOCs, very low total organic concentrations were detected on the first day (76 and 127 ug/m^3) whereas on the second day under light variable winds, the total

organic concentration was 546 ug/m^3. (This latter sample was more indicative of the general air quality in the lower industrial area of Hamilton during calm or low-wind days.) No naphthalene was detected in any of the samples and the major organics were the low-boiling alkanes and aromatics. Upon comparison with two similar days of monitoring in 1986, very few differences were noted in the data sets.

During inversions, overcast, rain and calm weather conditions, the monitoring units were usually at their overnight monitoring sites (Pier 24/25 or at J.I. Case). During these days of poor weather conditions, 5 VOC samples and 19 hours of common contaminant data were acquired. For the common contaminants, daily maximum half-hour average concentrations of TH-M ranged from 0.7 to 1.8 ppm; of CO, the range was 0.4 to 3.1 ppm; of NO_x, the range was 0.05 to 0.63 ppm; of TRS, the range was less than 0.002 ppm to 0.012 ppm; and of SO_2, the range was 0.02 to 0.05 ppm. For the VOCs, the total organic concentrations ranged from 130 to 627 ug/m^3 (an average of 417 ug/m^3) with the alkanes and aromatics comprising approximately 60 and 30% of these totals respectively. As the more dominant contaminants were CO and the low-boiling alkanes, the major source was deemed to be vehicular emissions. Although elevated concentrations were also measured during these times, none of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded.

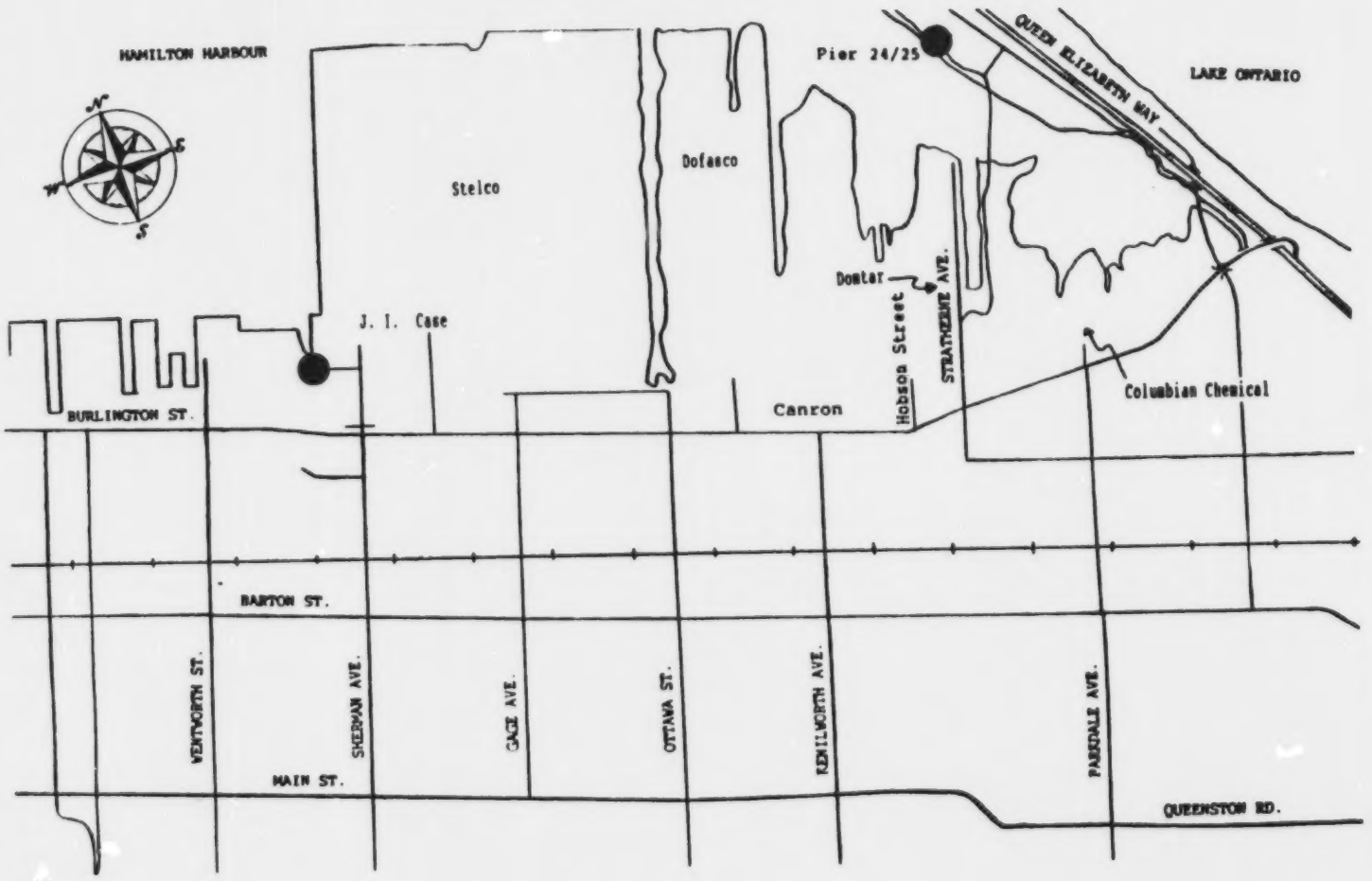
During the overnight and other long-term monitoring periods, the monitoring units were also at the Pier 24/25 or J.I. Case sites. The units were usually left unattended and as a result, only common contaminant measurements were undertaken. From almost 300 hours of common contaminant data acquired at the Pier 24/25 site, the daily maximum one-hour average concentrations for TH-M ranged from 0.5 to 1.6 ppm; for CO, from 0.5 to 6.3 ppm; for NO_2, from 0.04 to 0.08 ppm; and for TRS, from less than 0.002 ppm to 0.076 ppm. From the 325 hours of common contaminant data acquired at the J.I. Case site, the maximum one-hour average concentrations for TH-M ranged from 0.3 to 4.8 ppm; for CO, from 0.8 to 3.3 ppm; for NO_2, from 0.04 to 0.09 ppm; for TRS, from less than 0.002 ppm to 0.016 ppm; and for SO_2, from less than 0.01 ppm to 0.04 ppm. Very little difference was noted between these two data sets and that obtained during the 1986 survey of the same nature.

One of the mobile units undertook a special 'slow mobile' traverse along the West Service Road and Beach Boulevard. The winds were brisk and westerly. Apart from a relatively uniform background concentration of TH-M, two weak yet distinct plumes were recorded by the CO, NO_x and TRS analyzers during this exercise. The source(s) of these plumes could not be determined and the maximum one-minute average concentrations of CO, TH-M, TRS and NO_x measured during this traverse were 2.2, 0.9, 0.008 and 0.18 ppm respectively.

In conclusion, very few differences were noted in the 1987, 1986 and 1985 data sets. In general, CO, NO_x, TRS, some aromatic hydrocarbons and naphthalene continue to remain an environmental concern in the lower industrial sector of Hamilton.

APPENDIX ..... The Data

General Industrial Area Map - Hamilton



● LONG-TERM AND OVERNIGHT MONITORING SITES

Figure 1

Table 1

THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #1

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH4, TH-M analyzer	Ingenieur-Produktions-Gruppe Munchen (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH4)
H2S, SO2, NOx sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS/SO2 analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	0.5 ppm SO2 0.5 ppm TRS
NOx, NO2, NO analyzer	Monitor Labs 8840	Chemi-Luminescence	1.0 ppm NOx (as NO2)
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO (digital)
O3 analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O3 (digital)
Hewlett Packard Data Acquisition System - HP 85 and HP 3497A			
Gas Chromatograph	HP 5880 Dual Capillary Column c/w HP 86 Data Acquisition System	Flame Ionization Det.	as set per calibrations

Meteorological Instrumentation

Instrument	Manufacturer	Scale
** Wind speed	Lambrecht GmBH	km/hr
** Wind direction	Lambrecht GmBH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsius
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm2

** These instruments are located on top of a 10 metre retractable tower

Table 1 ctd.

THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #2

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH4, TH-M analyzer	Ingenieur-Produktions-Gruppe Munchen (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH4)
H2S, SO2, NOx sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	0.5 ppm H2S
SO2 analyzer	Monitor Labs 8850	Fluorescence	0.5 ppm SO2
NOx, NO2, NO analyzer	Monitor Labs 8840	Chemi-Luminescence	1.0 ppm NOx (as NO2)
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO (digital)
O3 analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O3 (digital)
Hg analyzer	Scintrex HGP-2	UV Absorption	50 ug/m3
Hewlett Packard Data Acquisition System - HP 85 and HP 3497A			
Gas Chromatograph	HP 5880 Dual Capillary Column c/w HP 86 Data Acquisition System	Flame Ionization Det.	as set per calibrations

Meteorological Instrumentation

Instrument	Manufacturer	Scale
** Wind speed	Lambrecht GmBH	km/hr
** Wind direction	Lambrecht GmBH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsius
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm2

** These instruments are located on top of a 10 metre retractable tower

Table 2

VOC Characteristics as Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in ug/m³ (micrograms per cubic metre)

		Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
1	PROPANE					
2	PROPADIENE					ALLENE
3	PROPYNE					METHYL ACETYLENE
4	CYCLOPROPANE					
5	2-METHYLPROPANE					ISOBUTANE
6	CHLOROETHENE	560 (2)	280 (A)	5000	10000	VINYL CHLORIDE; CHLOROETHYLENE
7	1-BUTENE					
8	1,3-BUTADIENE					
9	BUTANE			1900000		*n-BUTANE*
10	1-BUTYNE					ETHYLACETYLENE
11	CHLOROETHANE			2600000	3250000	ETHYL CHLORIDE
12	3-METHYL-1-BUTENE					ISOAMYLENE
13	2-METHYLBUTANE					ISOPENTANE
14	2-METHYL-1-BUTENE					
15	PENTANE			1800000	2250000	*N-PENTANE*
16	2-METHYL-1,3-BUTADIENE					ISOPRENE
17	trans-2-PENTENE					
18	cis-2-PENTENE					
19	DICHLOROMETHANE	100000 (1)	100000 (B)	350000	1740000	METHYLENE CHLORIDE
20	2-METHYL-2-BUTENE					

Table 2 ctd.

VOC Characteristics as Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in ug/m³ (micrograms per cubic metre)

	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
21 2,2-DIMETHYLBUTANE					NEOHEXANE
22 trans-1,2-DICHLOROETHENE					
23 3-METHYL-1-PENTENE					
24 4-METHYL-1-PENTENE					
25 CYCLOPENTANE					
26 2,3-DIMETHYLBUTANE					
27 2-METHYLPENTANE					
28 3-METHYLPENTANE					
29 1-HEXENE					
30 cis-1,2-DICHLOROETHENE			790000	1000000	cis-1,2-DICHLOROETHYLENE; SYM-DICHLOROETHYLENE
31 2-CHLOROBUTANE					sec-BUTYL CHLORIDE
32 1-CHLORO-2-METHYLPROPANE					
33 HEXANE	35000 (2)	12000 (A)	180000		*n-HEXANE*
34 TRICHLOROMETHANE	1500 (2)	500 (A)	50000	225000	CHLOROFORM
35 trans-3-HEXENE					
36 3-CHLORO-2-METHYLPROPENE					ISOBUTENYL CHLORIDE
37 METHYLCYCLOPENTANE					
38 2,4-DIMETHYLPENTANE					
39 1,2-DICHLOROETHANE			40000	60000	ETHYLENE CHLORIDE
40 2,2-DIMETHYLPENTANE					

Table 2 ctd.

VOC Characteristics as Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in ug/m³ (micrograms per cubic metre)

		Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
41	2,2,3-TRIMETHYLBUTANE					
42	1,1,1-TRICHLOROETHANE	350000 (1)	115000 (A)	19000000	2450000	METHYL CHLOROFORM
43	1-CHLOROBUTANE					n-BUTYL CHLORIDE
44	BENZENE	10000 (1)	3300 (A)	30000	75000	
45	TETRACHLOROMETHANE	1800 (2)	600 (A)	20000	125000	CARBON TETRACHLORIDE
46	3,3-DIMETHYLPENTANE					
47	CYCLOHEXANE	300000 (2)	100000 (A)	1050000	1300000	HEXAHYDROBENZENE
48	2,3-DIMETHYLPENTANE					
49	2-METHYLHEXANE					ISOHEPTANE
50	CYCLOHEXENE			1015000		
51	DIBROMOMETHANE					METHYLENE DIBROMIDE; METHYLENE BROMIDE
52	1,2-DICHLOROPROPANE					PROPYLENE CHLORIDE
53	3-METHYLHEXANE					
54	2,3-DICHLOROPROPENE			5000	50000	2,3-DICHLOROPROPYLENE
55	TRICHLOROETHENE	85000 (1)	28000 (A)	270000	1080000	TRICHLOROETHYLENE
56	2,2,4-TRIMETHYLPENTANE					ISOOCTANE
57	1-HEPTENE					
58	HEPTANE			1600000	2000000	"n-HEPTANE"
59	trans-2-HEPTENE					
60	METHYLCYCLOHEXANE			1600000	2000000	HEXAHYDROTOLUENE

Table 2 ctd.

VOC Characteristics as Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in ug/m³ (micrograms per cubic metre)

	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
61 2,2-DIMETHYLHEXANE					
62 ETHYLCYCLOPENTANE					
63 4-METHYLCYCLOHEXENE					
64 2,5-DIMETHYLHEXANE					
65 1-CHLOROPENTANE					n-AMYL CHLORIDE; PENTYL CHLORIDE
66 1,1,2-TRICHLOROETHANE					VINYL TRICHLORIDE
67 2,3,4-TRIMETHYLPENTANE					
68 TOLUENE	2000 (1)	2000 (A)	375000	560000	*METHYLBENZENE*; PHENYLMETHANE
69 1,3-DICHLOROPROPANE			350000	510000	TRIMETHYLENE CHLORIDE
70 2-METHYLHEPTANE					
71 4-METHYLHEPTANE					
72 c-1,3-DIMETHYLCYCLOHEXANE					
73 3-METHYLHEPTANE					
74 1,2-DIBROMOETHANE					ETHYLENE DIBROMIDE; ETHYLENE BROMIDE
75 1,i-DIMETHYLCYCLOHEXANE					
76 1-OCTENE	150000 (3)	50000 (A)			
77 trans12DIMETHYLCYCLOHEXANE					*trans-1,2-DIMETHYLCYCLOHEXANE
78 trans-4-OCTENE					
79 TETRACHLOROETHENE	10000 (2)	4000 (A)	335000	1340000	TETRACHLOROETHYLENE; PERCHLOROETHYLENE
80 c-1,4-DIMETHYLCYCLOHEXANE					

Table 2 ctd.

VOC Characteristics as Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in ug/m³ (micrograms per cubic metre)

	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
81 OCTANE	45400 (3)	15300 (A)	1450000	1800000	*n-OCTANE*
82 trans-2-OCTENE					
83 cis12DIMETHYLCYCLOHEXANE					
84 CHLOROBENZENE			350000		PHENYL CHLORIDE
85 ETHYLCYCLOHEXANE					
86 1-CHLOROHEXANE	4000 (1)	4000 (B)	435000	545000	n-HEXYL CHLORIDE
87 ETHYLBENZENE	2300 (4)	2300 (A)	435000	655000	*1,3-DIMETHYLBENZENE*
88 m&p-XYLENES					
89 4-METHYLOCTANE					
90 2-METHYLOCTANE					
91 3-METHYLOCTANE					
92 STYRENE	400 (1)	400 (A)	215000	425000	*ETHENYLBENZENE*; PHENYLETHYLENE; VINYLBENZENE
93 1,4-DICHLOROBUTANE					
94 o-XYLENE	2300 (4)	2300 (A)	435000	655000	*1,2-DIMETHYLBENZENE*
95 1,1,2,2-TETRACHLOROETHANE					
96 1,2,3-TRICHLOROPROPANE			300000	450000	ACETYLENE TETRACHLORIDE TRICHLOROHYDRIN
97 1-NONENE					
98 trans-1,4-DICL-2-BUTENE					
99 NONANE	100 (3)	100 (B)	1050000	1300000	*n-NONANE*
100 ISOPROPYLBENZENE					*(1-METHYLETHYL)BENZENE*; CUMENE

Table 2 ctd.

VOC Characteristics as Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in ug/m³ (micrograms per cubic metre)

	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
101 2-CHLOROTOLUENE					*2-CHLORO-1-METHYLBENZENE*; o-TOLYL CHLORIDE; o-CHLOROTOLUENE
102 3-CHLOROTOLUENE					*3-CHLORO-1-METHYLBENZENE*; m-TOLYL CHLORIDE; m-CHLOROTOLUENE
103 4-CHLOROTOLUENE					*4-CHLORO-1-METHYLBENZENE; p-TOLYL CHLORIDE; p-CHLOROTOLUENE
104 PROPYLBENZENE					n-PROPYLBENZENE
105 3-ETHYLTOLUENE					*1-ETHYL-3-METHYLBENZENE*; M-ETHYLTOLUENE
106 4-ETHYLTOLUENE					*1-ETHYL-4-METHYLBENZENE*; P-ETHYLTOLUENE
107 1,3,5-TRIMETHYLBENZENE			125000	170000	MESITYLENE
108 2-ETHYLTOLUENE					*1-ETHYL-2-METHYLBENZENE*; O-ETHYLTOLUENE
109 1,2,4-TRIMETHYLBENZENE	100 (2)	1000 (A)	125000	170000	PSUEDOCUMENE
110 tert.BUTYLBENZENE					*(1,1-DIMETHYLETHYL)BENZENE*
111 tert.BUTYLCYCLOHEXANE					
112 1,3-DICHLOROBENZENE					
113 1-DECENE	180000 (3)	60000 (A)			n-DECYLENE
114 (CHLOROMETHYL)BENZENE					alpha-CHLOROTOLUENE; BENZYL CHLORIDE
115 1,5-DICHLOROPENTANE					
116 isoBUTYLBENZENE					
117 DECANE					*n-DECANE*
118 sec.BUTYLBENZENE					*(1-METHYLPROPYL)BENZENE*
119 3-(CHLOROMETHYL)HEPTANE					
120 1,2,3-TRIMETHYLBENZENE			125000	175000	HEMIMELLITENE

Table 2 ctd.

VOC Characteristics as Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in ug/m³ (micrograms per cubic metre)

	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
121 1ISOPROPYL4METHYLBENZENE					*METHYL(4-METHYLETHYL)BENZENE*; 3-ISOPROPYLTOLUENE; P-CYMENE
122 1,2-DICHLOROBENZENE					o-DICHLOROBENZENE
123 INDAN					*2,3-DIHYDRO-1H-INDENE*; 2,3-DIHYDROINDENE; HYDRINDENE
124 BUTYLCYCLOHEXANE					n-BUTYLCYCLOHEXANE; 1-CYCLOHEXYLBUTANE
125 1,3-DIETHYLBENZENE					m-DIETHYLBENZENE
126 1,4-DIETHYLBENZENE					p-DIETHYLBENZENE
127 BUTYLBENZENE					n-BUTYLBENZENE
128 1,2-DIETHYLBENZENE					o-DIETHYLBENZENE
129 transDECAHYDRONAPHTHALENE					t-DECALIN; BICYCLO[4,4,0]DECANE
130 cis-DECAHYDRONAPHTHALENE					c-DECALIN; BICYCLO[4,4,0]DECANE
131 UNDECANE					*n-UNDECANE*; HENDECANE
132 1235-TETRAMETHYLBENZENE					ISODURENE
133 1234-TETRAMETHYLBENZENE					PREHNITENE
134 1,3-DIISOPROPYLBENZENE					*1,3-BIS(1-METHYLETHYL)BENZENE*
135 1234TETRAHYDRONAPHTHALENE					TETRALIN
136 1,4-DIISOPROPYLBENZENE					*1,4-BIS(1-METHYLETHYL)BENZENE*; ISOPROPYLCUMENE
137 NAPHTHALENE					
138 DODECANE	36 (3)	22.5 (A)			*n-DODECANE*

Table 2 ctd.

VOC Characteristics as Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in ug/m³ (micrograms per cubic metre)

NOTES:
(1) Standard
(2) Guideline
(3) Provisional Guideline
(4) Standard for the sum of o-, m-, & p- Xylenes

(A) Ambient Air Quality Criterion based on a 24-hour average concentration
(B) Ambient Air Quality Criterion based on a 1-hour average concentration
(please note; if the maximum 1-hour average concentration of a contaminant is LESS than the Criterion concentration based on a 24-hour average, then that Criterion has NOT been exceeded.)

TWA - Time Weighted Average for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed without adverse effect.

STEL - Short Term Exposure Limit - concentration to which workers can be exposed for a short period of time (15 minutes) without adverse effect.

* - Denotes name approved by the International Union of Pure and Applied Chemistry (IUPAC).

Table 2 ctd.

Characteristics of the Common Contaminants as Measured Continuously by MAMUs #1 AND #2

All concentrations are in terms of ppm (parts per million)

		Standards or Provisional Guidelines (0.5 hour)		Criterion (1 hour)	TWA	STEL		Alternate Names	
1 SULPHUR DIOXIDE	S	0.300		0.25	2	5		SO2	SULFUR DIOXIDE
2 TOTAL REDUCED SULPHUR	G	0.027	*	0.027	10	15	**	TRS	
3 NITROGEN OXIDES	S	0.25	***	N/A	-	-		NOx	OXIDES of NITROGEN
4 NITROGEN DIOXIDE		N/A		0.20	5	5		NO2	
5 NITRIC OXIDE		N/A		N/A	25	35		NO	NITROGEN MONOXIDE
6 OZONE	S	0.1		0.08	0.1	0.3		O3	
7 CARBON MONOXIDE	S	5.0		30.0	50	400		CO	

* As equivalent H2S and applicable only for Kraft Pulp Mills
TRS may contain any of the following: Hydrogen Sulphide (H2S), Methyl Mercaptan (CH3SH), Dimethyl Sulphide (C2H6S) and Dimethyl Disulphide (C2H6S2).

** The TWA and STEL for TRS is expressed solely for Hydrogen Sulphide concentrations

*** Expressed as NO2

S = Standard; G = Provisional Guideline

Table 3

Hamilton 1987 Air Quality Survey

Monitoring Periods and Site Information - MAMU#1

Monitoring Period *	Start Monitoring (hr/dd/mm)	Duration (hrs)	End Monitoring (hr/dd/mm)	Site Location	# GC Runs	Comments
A282	16:13/28/09	16.2	08:23/29/09	Pier 24/25	-	Overnight
A292	09:55/29/09	5.8	15:41/29/09	Pier 24/25	4	Downwind Cl.C.
A293	15:44/29/09	18.2	09:54/30/09	Pier 24/25	-	Overnight
A302	12:17/30/09	3.2	15:28/30/09	Canron Foundry	2	Upwind Canron
A303	16:01/30/09	16.8	08:46/01/10	Pier 24/25	-	Overnight
A012	11:06/01/10	4.7	15:45/01/10	Canron Foundry	-	Upwind Canron
A013	16:07/01/10	17.2	09:17/02/10	Pier 24/25	-	Overnight
A021	09:47/02/10	3.3	13:04/02/10	Pier 24/25	-	Shoreline
A022	13:10/02/10	0.6	13:45/02/10	Mobile Traverse	-	Mobile Scan
A023	13:58/02/10	41.4	07:23/04/10	Pier 24/25	-	Weekend
A062	14:15/06/10	18.4	08:40/07/10	Pier 24/25	-	Longterm
A072	09:34/07/10	6.5	16:02/07/10	Pier 24/25	-	Shoreline
A073	16:14/07/10	41.6	09:49/09/10	Pier 24/25	-	Shoreline
A142	14:43/14/10	1.3	16:02/14/10	Stelco Rod Mill 2	-	Upwind Domtar
A143	16:25/14/10	15.4	07:50/15/10	Pier 24/25	-	Overnight
A152	11:15/15/10	4.5	15:42/15/10	Strathearne Ave.	3	Downwind Domtar
A153	15:48/15/10	2.0	17:46/15/10	Stelco Rod Mill 2	1	Upwind Domtar
A154	17:59/15/10	1.9	19:52/15/10	Strathearne Ave.	-	Downwind Domtar
A155	20:13/15/10	12.5	08:42/16/10	Pier 24/25	-	Overnight
A161	08:42/16/10	1.1	09:48/16/10	Pier 24/25	-	Air Quality
A163	10:38/16/10	2.4	13:01/16/10	Pier 24/25	1	Air Quality (Veh.)
A164	14:05/16/10	1.0	15:03/16/10	Sam Lawrence Park	1	Air Quality (Inver.)
A165	16:26/16/10	67.5	11:56/19/10	Pier 24/25	-	Weekend
A192	14:32/19/10	1.1	15:39/19/10	Stelco Rod Mill 2	1	Downwind Domtar
A193	15:58/19/10	16.8	08:48/20/10	Pier 24/25	-	Overnight
A202	09:17/20/10	2.2	11:27/20/10	Pier 24/25	-	Shoreline
A203	12:11/20/10	2.3	14:28/20/10	J.I. Case	2	Downwind Stelco
A204	16:03/20/10	16.8	08:53/21/10	Pier 24/25	-	Overnight
A212	10:42/21/10	1.8	12:32/21/10	Industrial/Ottawa	-	Downwind Dofasco
A213	12:35/21/10	1.0	13:35/21/10	Industrial/Ottawa	1	Upwind (Traffic)

* In the designation of Monitoring Periods: 'A' refers to Mobile Air Monitoring Unit #1 (MAMU#1); the next two digits, the day of the month; and the final digit,

Table 3 ctd.

Hamilton 1987 Air Quality Survey

Monitoring Periods and Site Information - MAMU#2

Monitoring Period *	Start Monitoring (hr/dd/mm)	Duration (hrs)	End Monitoring (hr/dd/mm)	Site Location	# GC Runs	Comments
B282	15:39/28/09	17.1	08:44/29/09	J. I. Case	-	Overnight
B292	09:59/29/09	5.6	15:37/29/09	J. I. Case	4	Upwind Cl.C.
B293	15:45/29/09	17.5	09:15/30/09	J. I. Case	-	Overnight
B302	10:59/30/09	2.7	13:42/30/09	Canron	2	Fugative
B303	14:06/30/09	1.1	15:10/30/09	Employee P. Lot	1	Downwind Canron
B304	16:04/30/09	16.8	08:54/01/10	J. I. Case	-	Overnight
B012	11:28/01/10	1.3	12:45/01/10	Employee P. Lot	1	Downwind Canron
B013	14:14/01/10	1.5	15:43/01/10	Canron Foundry	1	Upwind Canron
B015	16:34/01/10	16.8	09:19/02/10	J. I. Case	-	Overnight
B022	13:33/02/10	67.7	09:13/05/10	J. I. Case	-	Weekend Mon.
B065	17:50/06/10	23.8	17:40/07/10	J. I. Case	-	Overnight
B121	17:28/12/10	18.5	09:58/13/10	J. I. Case	-	Overnight
B132	13:26/13/10	2.3	15:45/13/10	Dobson Rd.	2	Downwind Domtar
B133	16:18/13/10	16.1	08:23/14/10	J. I. Case	-	Overnight
B142	10:32/14/10	5.7	16:11/14/10	Strathearne Ave.	4	Downwind Domtar
B143	16:49/14/10	15.3	07:41/15/10	J. I. Case	-	Overnight
B152	11:34/15/10	4.4	15:57/15/10	Stelco P. Lot	1	Upwind Domtar
B153	16:10/15/10	1.2	17:19/15/10	Strathearne Ave	1	Downwind Domtar
B154	17:59/15/10	14.8	08:46/15/10	J. I. Case	-	Overnight
B162	11:03/16/10	1.7	12:42/16/10	J. I. Case	1	General A.Q.
B163	15:00/16/10	1.1	16:08/16/10	McMaster Univ.	1	General A.Q.
B164	17:08/16/10	67.3	12:23/19/10	J. I. Case	-	Weekend
B192	14:34/19/10	1.7	16:16/19/10	Strathearne Ave	1	Upwind Domtar
B193	16:22/19/10	16.4	08:47/20/10	J. I. Case	-	Overnight
B204	17:52/20/10	15.0	08:52/21/10	J. I. Case	-	Overnight

* *In the designation of Monitoring Periods: 'B' refers to Mobile Air Monitoring Unit #2 (MAMU#2); the next two digits, the day of the month; and the final digit, the data acquisition episode of the day.*

Table 4

Hamilton 1987 Air Quality Survey

Monitoring Periods & Suspected Source(s)

Colum.Chem.	Canron Fdy.	Domtar Ltd.	Stelco & Dofasco	General Air Q.
A292D (5.8)	A302U (3.2)	A142U (1.3)	A203D (2.3)	A021 (3.3)
B292U (5.6)	A012U (4.7)	A152D (4.5)	A212D (1.8)	A072 (6.5)
	B302D (2.7)	A153U (2.0)	A213U (1.0)	A161I (1.1)
	B303D (1.1)	A154U (1.9)		A163V (2.4)
	B012D (1.3)	A192D (1.1)		A164I (1.0)
	B013U (1.5)	B132D (2.3)		A202 (2.2)
		B142D (5.7)		B162 (1.7)
		B152U (4.4)		B163 (1.1)
		B153D (1.2)		
		B192U (1.7)		
Totals:				
11.4 hrs;	14.5 hrs;	26.1 hrs;	5.1 hrs;	19.3 hrs;

Overnight Monitoring

Pier 24/25	J.I. Case
A282 (16.2)	B282 (17.1)
A293 (18.2)	B293 (17.5)
A303 (16.8)	B304 (16.8)
A013 (17.2)	B015 (16.8)
A023 (41.4)	B022 (67.7)
A062 (18.4)	B065 (23.8)
A073 (41.6)	
	B121 (18.5)
	B133 (16.1)
A143 (15.4)	B143 (15.3)
A155 (12.5)	B154 (14.8)
A165 (67.5)	B164 (67.3)
A193 (16.8)	B193 (16.4)
A204 (16.8)	B204 (15.0)
Totals: 12 MPs & 299 hrs.	13 MPs & 323 hrs.

D ; Downwind
U ; Upwind
I ; Inversion
V ; Vehiclular Emissions

Table 5

Common Contaminants - Hamilton 1987 Air Quality Survey

Maximum ½-Hr Average Ground Level Concentrations (ppm)

Monitoring Period	TH-M	CO	NO_x	TRS	SO_2	Average Wind *
A292D	0.5	12.4	0.05	0.006	na.	2650
B292U	0.6	0.6	0.06	nd.	0.02	2826
A302U	0.7	0.9	0.12	0.017	na.	2934
B302D	3.1	11.2	0.13	0.007	0.05	3306
B303D	1.8	3.4	0.07	0.007	0.03	2911
A012U	1.0	1.8	0.07	0.008	na.	3025
B012D	1.1	3.7	0.05	0.003	0.01	2810
B013U	0.5	0.8	0.04	nd.	0.01	2417
B132D	0.9	0.6	0.12	0.003	0.02	1113
A142U	0.4	0.6	0.07	0.004	na.	2536
B142D	2.3	1.4	0.06	0.048	0.01	2021
A152D	2.3	0.6	0.15	0.105	na.	2215
B152U	1.0	3.1	0.07	nd.	0.02	2114
A153U	0.9	0.9	0.11	0.004	na.	2217
B153D	1.1	1.5	0.09	0.006	0.02	1415
A154D	1.6	1.8	0.19	0.007	na.	1714
A192D	1.5	2.0	0.29	0.019	na.	0705
B192U	6.8	12.9	0.38	nd.	0.03	3207
A203D	1.4	1.2	0.14	0.013	na.	0518
A212D	0.9	3.2	0.27	0.006	na.	2907
A213U	1.0	3.6	0.32	0.005	na.	2906
A021	0.9	0.4	0.05	0.008	na.	2552
A072	0.8	1.8	0.09	na.	na.	2848
A161I	1.4	3.1	0.63	0.007	na.	1103
B162V	1.7	2.4	0.14	0.012	0.05	2810
A163I	1.4	2.3	0.50	0.005	na.	0912
B163	1.1	1.8	0.05	nd.	0.02	1005
A164	1.8	3.1	0.49	0.011	na.	0711
A202	0.7	1.2	0.33	0.003	na.	3316

Monitoring Period - the 'A' refers to MAMU #1, and 'B' refers to MAMU #2; the next two digits, the day of the month; the next digit, the monitoring episode of the day; U - Upwind, D - Downwind, I - Nocturnal Inversion and V - Vehicular Exhaust

na. - this data is not available.

nd. - not detected; concentration in ambient air less than detection limit of analyzer. The detection limit for the TRS analyzer was 0.002 ppm and for the SO2 analyzer 0.01 ppm.

* - the first two digits refer to the direction (in tens of degrees) from which the wind was blowing and the last two digits refer to the speed in km/hr.

Table 5 ctd.

Common Contaminants - Hamilton 1987 Air Quality Survey

Overnight Monitoring

Maximum One-Hour Average Ground Level Concentrations (ppm)

Monitoring Period	TH-M	CO	NO_2	TRS	SO_2
A282	0.6	1.0	0.06	0.009	na.
A293	0.6	6.3	0.05	0.026	na.
A303	0.4	0.7	0.04	nd.	na.
A013	1.0	0.5	0.06	0.010	na.
A023	0.8	5.0	0.04	0.034	na.
A062	0.5	4.6	0.05	na.	na.
A073	0.8	3.9	0.04	na.	na.
A143	0.9	3.3	0.08	0.025	na.
A155	1.6	3.2	0.07	0.010	na.
A165	1.6	2.7	0.07	0.076	na.
A193	0.8	1.4	0.07	0.004	na.
A204	0.6	0.7	0.04	nd.	na.
B282	0.6	1.1	0.06	nd.	0.03
B293	1.2	1.0	0.05	nd.	nd.
B304	1.5	1.0	0.04	nd.	nd.
B015	0.3	0.9	0.06	nd.	nd.
B022	1.2	1.2	0.07	0.004	nd.
B065	1.6	1.2	0.05	0.003	nd.
B121	4.8	3.3	0.04	0.003	0.02
B133	1.6	0.9	0.05	0.006	0.03
B143	1.9	1.5	0.07	0.004	0.01
B154	3.5	2.3	0.09	0.007	0.02
B164	3.0	3.3	0.07	0.010	0.03
B193	1.1	1.4	0.07	0.016	0.04
B204	0.8	0.8	0.04	nd.	nd.

Monitoring Period - the 'A' refers to MAMU #1, and 'B' refers to MAMU #2; the next two digits, the day of the month; the next digit, the monitoring episode of the day;

na. - this data is not available.

nd. - not detected; concentration in ambient air less than detection limit of analyzer. The detection limit for the TRS analyzer was 0.002 ppm and for the SO2 analyzer 0.01 ppm.

Table 6

Hamilton 1987 VOC Sampling Summary

	Columbian Chemical		Canron Foundry		Domtar Limited		Stelco Ltd.	General Air Quality (Calm and Poor Dispersion Cdns.)
	Downwind Averages	Upwind Averages	Downwind Averages	Upwind Averages	Downwind Averages	Upwind Averages	Downwind Averages	Averages
Number of Samples	(4)	(4)	(4)	(3)	(11)	(3)	(2)	(5)
Volatile Organic Compounds								
PROPANE	10	9	12	6	16	13	6	27
2-METHYLPROPANE	2	3	5	1	4	7		17
1-BUTENE			3		2	3		5
BUTANE	7	9	15	6	16	22	17	51
2-METHYLBUTANE	5	5	18	7	11	16	16	36
2-METHYL-1-BUTENE			2					5
PENTANE	3	4	14	5	7	8	11	24
2-METHYL-1,3-BUTADIENE		1	3					
trans-2-PENTENE			2	1	1	2		3
cis-2-PENTENE			1			1		3
DICHLOROMETHANE		5	25					9
2-METHYL-2-BUTENE			3	1	2	2		4
2,2-DIMETHYLBUTANE			1			1		2
CYCLOPENTANE			2	1	1	2	2	3
2,3-DIMETHYLBUTANE			2	1	1	2	2	4
2-METHYLPENTANE	2	3	10	3	5	6	6	15
3-METHYLPENTANE	1	1	6	2	3	4	4	10
HEXANE	2	2	11	4	6	5	6	16
METHYLCYCLOPENTANE	1		3	1	2	2		6

Table 6 ctd.

Hamilton 1987 VOC Sampling Summary

	Columbian Chemical		Canron Foundry		Domtar Limited		Stelco Ltd.	General Air Quality (Calm and Poor Dispersion Cdns.)
Number of Samples	Downwind Averages (4)	Upwind Averages (4)	Downwind Averages (4)	Upwind Averages (3)	Downwind Averages (11)	Upwind Averages (3)	Downwind Averages (2)	Averages (5)
2,4-DIMETHYLPENTANE			2		1	1		2
1,1,1-TRICHLOROETHANE		9	7	8	13	4		8
BENZENE	8	7	26	22	164	9	13	19
TETRACHLOROMETHANE					46			14
3,3-DIMETHYLPENTANE			1					2
CYCLOHEXANE			1		8			3
2,3-DIMETHYLPENTANE	2		2		1	1		5
2-METHYLHEXANE	1		2		3	1	3	10
CYCLOHEXENE				2		4		
3-METHYLHEXANE	1	1	5	1	2	2	2	7
2,2,4-TRIMETHYLPENTANE			2		2	2	2	6
HEPTANE	1	1	9	1	2	2	2	6
METHYLCYCLOHEXANE	1		15		1	1		5
2,5-DIMETHYLHEXANE			4					1
1-CHLOROPENTANE			4					1
2,3,4-TRIMETHYLPENTANE			2		1	1		3
TOLUENE	5	15	43	7	70	12	18	47
2-METHYLHEPTANE			20		1	1		5
4-METHYLHEPTANE			6		1			4
c-1,3-DIMETHYLCYCLOHEXANE			10		2			3

Table 6 ctd.

Hamilton 1987 VOC Sampling Summary

	Columbian Chemical		Canron Foundry		Domtar Limited		Stelco Ltd.	General Air Quality (Calm and Poor Dispersion Cdns.)
	Downwind Averages	Upwind Averages	Downwind Averages	Upwind Averages	Downwind Averages	Upwind Averages	Downwind Averages	Averages
Number of Samples	(4)	(4)	(4)	(3)	(11)	(3)	(2)	(5)
3-METHYLHEPTANE			24		2			6
1,1-DIMETHYLCYCLOHEXANE			5					
transl2DIMETHYLCYCLOHEXANE			5					
TETRACHLOROETHENE			16		5			8
c-1,4-DIMETHYLCYCLOHEXANE								2
OCTANE		1	31		2	1		4
trans-2-OCTENE			4					
ETHYLCYCLOHEXANE			15					1
1-CHLOROHEXANE			8					
ETHYLBENZENE	1	5	41	2	25	3	2	8
M,P-XYLENE	4	16	123	6	45	8	7	23
4-METHYLOCTANE			11		3			1
2-METHYLOCTANE			11					1
3-METHYLOCTANE			12		1		9	2
STYRENE			7		15			
1,4-DICHLOROBUTANE			15		7			2
o-XYLENE	1	5	36	2	15	3	3	7
1-NONENE			7		2			1
trans-1,4-DICL-2-BUTENE			10					
NONANE		1	28	1	3	1	2	2

Table 6 ctd.

Hamilton 1987 VOC Sampling Summary

Number of Samples	Columbian Chemical		Canron Foundry		Domtar Limited		Stelco Ltd.	General Air Quality (Calm and Poor Dispersion Cdns.)
	Downwind Averages (4)	Upwind Averages (4)	Downwind Averages (4)	Upwind Averages (3)	Downwind Averages (11)	Upwind Averages (3)	Downwind Averages (2)	Averages (5)
ISOPROPYLBENZENE			4		3			
PROPYLBENZENE			6		2	1		2
3-ETHYLTOLUENE	1	2	12	2	7	2		3
4-ETHYLTOLUENE			8	1	9	1		6
1,3,5-TRIMETHYLBENZENE			8	1	7	1		3
2-ETHYLTOLUENE			5		2	1		2
tert.BUTYLBENZENE			8	2	4			4
1,2,4-TRIMETHYLBENZENE		1	25	5	15	3		3
sec.BUTYLBENZENE			3					
DECANE	2	2	23	2	5	2	2	5
1,2,3-TRIMETHYLBENZENE			9	2	4	1		2
1,2-DICHLOROBENZENE					2			2
INDAN			4		141			
BUTYLCYCLOHEXANE			4		3			1
BUTYLBENZENE			7	2	3			2
UNDECANE	2	2	13	4	4	1		5
1235-TETRAMETHYLBENZENE			5	2	2			
1234-TETRAMETHYLBENZENE			6	1	2			
NAPHTHALENE			2		28			2
DODECANE	3	2	5	4	4	1		5

Table 6 ctd.

Hamilton 1987 VOC Sampling Summary

	Columbian Chemical		Canron Foundry		Domtar Limited		Stelco Ltd.	General Air Quality (Calm and Poor Dispersion Cdns.)
	Downwind Averages	Upwind Averages	Downwind Averages	Upwind Averages	Downwind Averages	Upwind Averages	Downwind Averages	Averages
Number of Samples	(4)	(4)	(4)	(3)	(11)	(3)	(2)	(5)
Total Compounds Identified	19	21	58	20	34	27	16	42
Total Organic Conc.	59	104	772	77	603	131	102	416
Alkanes	39	43	275	44	92	89	80	254
Cycloalkanes	2	0	56	2	4	3	1	18
Alkenes	0	0	19	1	2	4	0	6
Cycloalkenes	0	0	0	1	0	1	0	0
Alkynes	0	0	0	0	0	0	0	0
Aromatics	19	52	355	27	492	33	21	118
Chlorinated Alkanes	0	8	48	3	11	1	0	14
Chlorinated Alkenes	0	0	20	0	0	0	0	6
Chlorinated Aromatics	0	0	0	0	1	0	0	0

Table 7

Hamilton 1987 : VOC Sampling Results

Columbian Chemical

Monitoring Period	A292	A292	A292	A292			B292	B292	B292	B292		
Sampling Site Information	d-CC	d-CC	d-CC	d-CC			u-CC	u-CC	u-CC	u-CC		
Sampling Date	SEP 29	SEP 29	SEP 29	SEP 29			SEP 29	SEP 29	SEP 29	SEP 29		
Sample Start Time	10:05	11:20	12:50	14:13	Downwind		09:58	11:08	13:02	14:29	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximu
Volatile Organic Compound												
PROPANE	12	9	10	8	9.8	12	9	8	9	9	9.0	9
2-METHYLPROPANE	3	2	2	2	2.4	3	4	3	3	3	3.2	4
1-BUTENE												
BUTANE	8	6	5	6	6.5	8	11	8	7	9	8.7	11
2-METHYLBUTANE	5	5	4	4	4.6	5	6	5	4	5	5.3	6
2-METHYL-1-BUTENE												
PENTANE	3	3	2	2	2.6	3	4	4	3	4	3.7	4
2-METHYL-1,3-BUTADIENE										1	1.4	1
trans-2-PENTENE												
cis-2-PENTENE												
DICHLOROMETHANE							5				5.1	5
2-METHYL-2-BUTENE												
2,2-DIMETHYLBUTANE												
CYCLOPENTANE												
2,3-DIMETHYLBUTANE												
2-METHYLPENTANE	2	2	2	2	2.0	2	3	2	2	2	2.5	3
3-METHYLPENTANE	1	1	1	2	1.4	2	2	1	1	1	1.5	2
HEXANE	2	2	2	3	2.1	3	3	2	3	2	2.5	3
METHYLCYCLOPENTANE			1	1	1.3	1						
2,4-DIMETHYLPENTANE												

Table 7 ctd.

Hamilton 1987 : VOC Sampling Results

Columbian Chemical

Monitoring Period	A292	A292	A292	A292			B292	B292	B292	B292		
Sampling Site Information	d-CC	d-CC	d-CC	d-CC			u-CC	u-CC	u-CC	u-CC		
Sampling Date	SEP 29	SEP 29	SEP 29	SEP 29			SEP 29	SEP 29	SEP 29	SEP 29		
Sample Start Time	10:05	11:20	12:50	14:13	Downwind		09:58	11:08	13:02	14:29	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximu
Volatile Organic Compound												
1,1,1-TRICHLOROETHANE							7	4	17		9.0	17
BENZENE	9	4	12	6	7.8	12	6	6	8	9	7.4	9
TETRACHLOROMETHANE												
3,3-DIMETHYLPENTANE												
CYCLOHEXANE												
2,3-DIMETHYLPENTANE	1		2	1	1.5	2						
2-METHYLHEXANE	1	1	2	1	1.4	2						
CYCLOHEXENE												
3-METHYLHEXANE			1		1.0	1	1		1		1.2	1
2,2,4-TRIMETHYLPENTANE												
HEPTANE	1		1	1	1.1	1	1	1	1		1.3	1
METHYLCYCLOHEXANE	1		1	1	1.2	1						
2,5-DIMETHYLHEXANE												
1-CHLOROPENTANE												
2,3,4-TRIMETHYLPENTANE												
TOLUENE	5		6	5	5.3	6	19	24	12	6	15.1	24
2-METHYLHEPTANE												
4-METHYLHEPTANE												
c-1,3-DIMETHYLCYCLOHEXANE												
3-METHYLHEPTANE												

Table 7 ctd.

Hamilton 1987 : VOC Sampling Results

Columbian Chemical

Monitoring Period	A292	A292	A292	A292			B292	B292	B292	B292		
Sampling Site Information	d-CC	d-CC	d-CC	d-CC			u-CC	u-CC	u-CC	u-CC		
Sampling Date	SEP 29	SEP 29	SEP 29	SEP 29			SEP 29	SEP 29	SEP 29	SEP 29		
Sample Start Time	10:05	11:20	12:50	14:13	Downwind		09:58	11:08	13:02	14:29	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximu
Volatile Organic Compound												
1,1-DIMETHYLCYCLOHEXANE												
trans12DIMETHYLCYCLOHEXAN												
TETRACHLOROETHENE												
c-1,4-DIMETHYLCYCLOHEXANE												
OCTANE							1	1			1.2	1
trans-2-OCTENE												
ETHYLCYCLOHEXANE												
1-CHLOROHEXANE												
ETHYLBENZENE	1	1	1	1	1.1	1	7	7	4	2	5.0	7
M,P-XYLENE	5	3	5	3	4.1	5	23	25	13	4	16.5	25
4-METHYLOCTANE												
2-METHYLOCTANE												
3-METHYLOCTANE												
STYRENE												
1,4-DICHLOROBUTANE												
o-XYLENE	2	1	2	1	1.4	2	8	8	4	1	5.4	8
1-NONENE												
trans-1,4-DICL-2-BUTENE												
NONANE							1	1			1.2	1
ISOPROPYLBENZENE												

Table 7 ctd.

Hamilton 1987 : VOC Sampling Results

Columbian Chemical

Monitoring Period	A292	A292	A292	A292			B292	B292	B292	B292		
Sampling Site Information	d-CC	d-CC	d-CC	d-CC			u-CC	u-CC	u-CC	u-CC		
Sampling Date	SEP 29	SEP 29	SEP 29	SEP 29			SEP 29	SEP 29	SEP 29	SEP 29		
Sample Start Time	10:05	11:20	12:50	14:13	Downwind		09:58	11:08	13:02	14:29	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximu
Volatile Organic Compound												
PROPYLBENZENE												
3-ETHYLTOLUENE	1		1	1	1.2	1	1	1	2	2	1.5	2
4-ETHYLTOLUENE												
1,3,5-TRIMETHYLBENZENE												
2-ETHYLTOLUENE												
tert.BUTYLBENZENE												
1,2,4-TRIMETHYLBENZENE							2	1	1	1	1.5	2
sec.BUTYLBENZENE												
DECANE	2				1.7	2	3	1	1		1.7	3
1,2,3-TRIMETHYLBENZENE												
1,2-DICHLOROBENZENE												
INDAN												
BUTYLCYCLOHEXANE												
BUTYLBENZENE												
UNDECANE	2				1.8	2	4	2	2		2.4	4
1235-TETRAMETHYLBENZENE												
1234-TETRAMETHYLBENZENE												
NAPHTHALENE												
DODECANE	4	4	2	2	2.8	4		2	1		1.6	2

Table 7 ctd.

Hamilton 1987 : VOC Sampling Results

Columbian Chemical

Monitoring Period	A292	A292	A292	A292			B292	B292	B292	B292		
Sampling Site Information	d-CC	d-CC	d-CC	d-CC			u-CC	u-CC	u-CC	u-CC		
Sampling Date	SEP 29	SEP 29	SEP 29	SEP 29			SEP 29	SEP 29	SEP 29	SEP 29		
Sample Start Time	10:05	11:2	12:50	14:13	Downwind		09:58	11:08	13:02	14:29	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximu
Total Compounds Identified	21	14	21	20	19	21	23	22	21	16	21	23
Total Organic Conc. (ug/m3)	71	44	67	55	59.4	71	131	120	101	62	103.8	131
Alkanes (ug/m3)	47	36	36	35	38.7	47	54	43	39	36	43.1	54
Cycloalkanes (ug/m3)	1	0	3	2	1.5	3	0	0	0	0	0.0	0
Alkenes (ug/m3)	0	0	0	0	0.0	0	0	0	0	1	0.4	1
Cycloalkenes (ug/m3)	0	0	0	0	0.0	0	0	0	0	0	0.0	0
Alkynes (ug/m3)	0	0	0	0	0.0	0	0	0	0	0	0.0	0
Aromatics (ug/m3)	23	8	28	18	19.2	28	66	73	45	25	52.3	73
Chlorinated Alkanes (ug/m3)	0	0	0	0	0.0	0	12	4	17	0	8.0	17
Chlorinated Alkenes (ug/m3)	0	0	0	0	0.0	0	0	0	0	0	0.0	0
Chlorinated Aromatics (ug/m3)	0	0	0	0	0.0	0	0	0	0	0	0.0	0

Table 8

Hamilton '87 : VOC Sampling Results

Canron Foundry

Monitoring Period	B302	B302	B303	B012			A302	A302	B013		
Sampling Site Information	d-CF	d-CF	d-CF	d-CF			u-CR	u-CR	u-CF		
Sampling Date	SEP 30	SEP 30	SEP 30	OCT 1			SEP 30	SEP 30	OCT 1		
Sample Start Time	10:58	12:30	14:05	11:29	Downwind		12:30	14:10	14:10	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound											
PROPANE	14	13	10	12	12.2	14	7	7	3	5.6	7
2-METHYLPROPANE	5	4	4	7	5.0	7	1	1	3	1.4	3
1-BUTENE				3	2.8	3					
BUTANE	16	14	10	19	14.8	19	4	4	10	6.0	10
2-METHYLBUTANE	24	24	9	16	18.4	24	5	5	9	6.5	9
2-METHYL-1-BUTENE	2	2			2.1	2					
PENTANE	19	18	6	11	13.6	19	4	4	6	4.7	6
2-METHYL-1,3-BUTADIENE	2	3			2.6	3					
trans-2-PENTENE	2	2	1	2	2.0	2			1	1.1	1
cis-2-PENTENE	1	1			1.3	1					
DICHLOROMETHANE	44	20	12		25.5	44					
2-METHYL-2-BUTENE	4	4	1	2	3.1	4			1	1.5	1
2,2-DIMETHYLBUTANE	1	1			1.4	1					
CYCLOPENTANE	3	3	1	2	2.0	3			1	1.1	1
2,3-DIMETHYLBUTANE	3	4	1	2	2.4	4			1	1.0	1
2-METHYLPENTANE	13	15	4	7	9.8	15	2	2	4	3.0	4
3-METHYLPENTANE	8	9	4	4	6.3	9	2	2	3	2.3	3
HEXANE	15	15	7	7	11.1	15	3	4	6	4.1	6
METHYLCYCLOPENTANE	5	5	2	2	3.3	5	1	1	1	1.1	1
2,4-DIMETHYLPENTANE	2	2			2.2	2					

Table 8 ctd.

Hamilton '87 : VOC Sampling Results

Canron Foundry

Monitoring Period	B302	B302	B303	B012			A302	A302	B013		
Sampling Site Information	d-CF	d-CF	d-CF	d-CF			u-CR	u-CR	u-CF		
Sampling Date	SEP 30	SEP 30	SEP 30	OCT 1			SEP 30	SEP 30	OCT 1		
Sample Start Time	10:58	12:30	14:05	11:29	Downwind		12:30	14:10	14:10	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound											
1,1,1-TRICHLOROETHANE	7	11	7	3	7.2	11			8	7.6	8
BENZENE	31	56	8	11	26.5	56	30		14	21.8	30
TETRACHLOROMETHANE											
3,3-DIMETHYLPENTANE	1	1			1.3	1					
CYCLOHEXANE	1	2			1.5	2					
2,3-DIMETHYLPENTANE	3	3	1	1	1.9	3					
2-METHYLHEXANE			2		2.2	2					
CYCLOHEXENE							2	2		1.9	2
3-METHYLHEXANE	8	7	3	3	4.9	8			1	1.3	1
2,2,4-TRIMETHYLPENTANE			2		2.5	2					
HEPTANE	16	8	9	3	8.9	16			1	1.2	1
METHYLCYCLOHEXANE	29	9	20	2	15.0	29					
2,5-DIMETHYLHEXANE	6	2	3		3.6	6					
1-CHLOROPENTANE	7	5	2		4.4	7					
2,3,4-TRIMETHYLPENTANE		4		1	2.4	4					
TOLUENE	69	53	32	17	42.7	69			7	7.0	7
2-METHYLHEPTANE	45	12	22	2	20.4	45					
4-METHYLHEPTANE	9		4		6.4	9					
c-1,3-DIMETHYLCYCLOHEXANE	22	6	8	2	9.6	22					
3-METHYLHEPTANE	37	11			23.7	37					

Table 8 ctd.

Hamilton '87 : VOC Sampling Results

Canron Foundry

Monitoring Period	B302	B302	B303	B012			A302	A302	B013		
Sampling Site Information	d-CF	d-CF	d-CF	d-CF			u-CR	u-CR	u-CF		
Sampling Date	SEP 30	SEP 30	SEP 30	OCT 1			SEP 30	SEP 30	OCT 1		
Sample Start Time	10:58	12:30	14:05	11:29	Downwind		12:30	14:10	14:10	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound											
1,1-DIMETHYLCYCLOHEXANE	8	2	4		5.0	8					
trans12DIMETHYLCYCLOHEXAN	8	2	4		4.9	8					
TETRACHLOROETHENE	25	9	15		16.0	25					
c-1,4-DIMETHYLCYCLOHEXANE											
OCTANE	68	20	32	5	31.3	68					
trans-2-OCTENE	6	2	3		3.7	6					
ETHYLCYCLOHEXANE	33	9	14	3	14.9	33					
1-CHLOROHEXANE	11	5			7.7	11					
ETHYLBENZENE	75	45	35	8	40.6	75			2	1.7	2
M,P-XYLENE	233	133	102	24	122.8	233			6	6.0	6
4-METHYLOCTANE	22	9	10	3	11.1	22					
2-METHYLOCTANE	22	9	10	3	10.8	22					
3-METHYLOCTANE	25	10	10	3	11.9	25					
STYRENE		7			6.5	7					
1,4-DICHLOROBUTANE	28	17	10	4	14.7	28					
o-XYLENE	73	32	32	9	36.4	73			2	2.2	2
1-NONENE	14	8	6	2	7.4	14					
trans-1,4-DICL-2-BUTENE	15	10	7		10.5	15					
NONANE	48	35	22	6	28.0	48			1	1.0	1
ISOPROPYLBENZENE	6		3		4.3	6					

Table 8 ctd.

Hamilton '87 : VOC Sampling Results

Canron Foundry

Monitoring Period	B302	B302	B303	B012					A302	A302	B013			
Sampling Site Information	d-CF	d-CF	d-CF	d-CF					u-CR	u-CR	u-CF			
Sampling Date	SEP 30	SEP 30	SEP 30	OCT 1					SEP 30	SEP 30	OCT 1			
Sample Start Time	10:58	12:30	14:05	11:29	Downwind				12:30	14:10	14:10	Upwind		
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum			0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	
Compound														
PROPYLBENZENE	10			2	6.0	10								
3-ETHYLTOLUENE	21	16	8	5	12.3	21					2	2.4	2	
4-ETHYLTOLUENE	13			3	7.9	13			1		1	1.3	1	
1,3,5-TRIMETHYLBENZENE	13		5	4	7.5	13					1	1.4	1	
2-ETHYLTOLUENE	8		4	2	4.5	8								
tert.BUTYLBENZENE	13		6	4	7.6	13					2	1.6	2	
1,2,4-TRIMETHYLBENZENE	39	29	19	12	24.6	39					5	5.4	5	
sec.BUTYLBENZENE	1	4			2.8	4								
DECANE	35		22	11	22.6	35			1		2	1.8	2	
1,2,3-TRIMETHYLBENZENE	15		8	4	9.3	15					2	1.6	2	
1,2-DICHLOROBENZENE														
INDAN	4				3.7	4								
BUTYLCYCLOHEXANE	6		4	2	3.8	6								
BUTYLBENZENE	13		6	4	7.4	13					2	1.7	2	
UNDECANE	24	3		10	12.5	24			5	1	5	3.6	5	
1235-TETRAMETHYLBENZENE	8			3	5.4	8					2	1.6	2	
1234-TETRAMETHYLBENZENE	8	9		3	6.3	9					1	1.4	1	
NAPHTHALENE	1	3			2.2	3								
DODECANE	5	5		4	4.5	5			4	2	7	4.2	7	

Table 8 ctd.

Hamilton '87 : VOC Sampling Results

Canron Foundry

Monitoring Period	B302	B302	B303	B012			A302	A302	B013		
Sampling Site Information	d-CF	d-CF	d-CF	d-CF			u-CR	u-CR	u-CF		
Sampling Date	SEP 30	SEP 30	SEP 30	OCT 1			SEP 30	SEP 30	OCT 1		
Sample Start Time	10:58	12:30	14:05	11:29	Downwind		12:30	14:10	14:10	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound											
Total Compounds Identified	70	59	54	50	58	70	15	12	34	20	34
Total Organic Conc. (ug/m3)	1432	782	595	280	772.3	1432	71	35	125	77.0	125
Alkanes (ug/m3)	494	259	208	139	275.1	494	37	32	63	44.1	63
Cycloalkanes (ug/m3)	116	39	57	11	55.8	116	1	1	3	1.5	3
Alkenes (ug/m3)	33	22	11	9	18.8	33	0	0	3	0.8	3
Cycloalkenes (ug/m3)	0	0	0	0	0.0	0	2	2	0	1.3	2
Alkynes (ug/m3)	0	0	0	0	0.0	0	0	0	0	0.0	0
Aromatics (ug/m3)	653	386	266	113	354.6	653	31	0	49	26.8	49
Chlorinated Alkanes (ug/m3)	97	58	31	7	48.1	97	0	0	8	2.5	8
Chlorinated Alkenes (ug/m3)	39	19	22	0	19.9	39	0	0	0	0.0	0
Chlorinated Aromatics (ug/m3)	0	0	0	0	0.0	0	0	0	0	0.0	0

Table 9

Hamilton '87 : VOC Sampling Results

Domtar (Cassidy Works) tar plant

Monitoring Period	B132	B132	B142	B142	B142	B142	A152	A152	A152	B153	A192			B152	A153	B192		
Sampling Site Information	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR			u-DR	u-DR	u-DR		
Sampling Date	OCT 13	OCT 13	OCT 14	OCT 14	OCT 14	OCT 14	OCT 15	OCT 15	OCT 15	OCT 15	OCT 19			OCT 15	OCT 15	OCT 19		
Sample Start Time	13:25	14:36	10:20	11:43	13:30	14:45	11:35	13:00	14:30	16:05	14:30	Downwind		11:40	16:00	14:34	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound																		
PROPANE	9	89	10	6	9	17	4	5	6	6	13	15.9	89	7	14	17	12.8	17
2-METHYLPROPANE	3	3	6	4	4	4			6	4	6	4.5	6	8	5	10	7.4	10
1-BUTENE	2			1	2	2						1.7	2			3	3.0	3
BUTANE	10	6	20	11	14	12	19	24	17	12	28	15.7	28	22	17	26	22.3	26
2-METHYLBUTANE	6	5	15	8	9	8	13	14	12	9	25	11.3	25	14	12	21	16.1	21
2-METHYL-1-BUTENE																		
PENTANE	4	3	9	5	6	5	8	8	8	6	18	7.3	18	9	1	13	7.8	13
2-METHYL-1,3-BUTADIENE																		
trans-2-PENTENE			2		1					1		1.4	2	1		2	1.8	2
cis-2-PENTENE																1	1.1	1
DICHLOROMETHANE																		
2-METHYL-2-BUTENE			2	1	1					2		1.6	2	2		3	2.3	3
2,2-DIMETHYLBUTANE																1	1.1	1
CYCLOPENTANE			1	1	1	1			1	1		1.1	1	1		2	1.6	2
2,3-DIMETHYLBUTANE			1	1	1	1		1	1	1		1.1	1	1		2	1.7	2
2-METHYLPENTANE	3	2	6	4	4	4	5	6	8	5		4.7	8	4		8	6.2	8
3-METHYLPENTANE	2	2	4	3	3	3	3	5	6	3		3.3	6	3		5	3.9	5
HEXANE	4	3	6	4	4	5	5	9	12	4	9	5.8	12	4		7	5.5	7
METHYLCYCLOPENTANE	1		2	1	2	2	2	2	3	2		1.7	3	2	2	2	1.8	2
2,4-DIMETHYLPENTANE										1		1.0	1			1	1.0	1

Table 9 ctd.

Hamilton '87 : VOC Sampling Results

Domtar (Cassidy Works) tar plant

Monitoring Period	B132	B132	B142	B142	B142	B142	A152	A152	A152	B153	A192			B152	A153	B192		
Sampling Site Information	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR			u-DR	u-DR	u-DR		
Sampling Date	OCT 13	OCT 13	OCT 14	OCT 14	OCT 14	OCT 14	OCT 15	OCT 15	OCT 15	OCT 15	OCT 19			OCT 15	OCT 15	OCT 19		
Sample Start Time	13:25	14:36	10:20	11:43	13:30	14:45	11:35	13:00	14:30	16:05	14:30	Downwind		11:40	16:00	14:34	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound																		
1,1,1-TRICHLOROETHANE	3			3		28			30	2		13.1	30			4	3.7	4
BENZENE	14	54	244	191	191	230	237	299	155	27		164.3	299	5		13	9.2	13
TETRACHLOROMETHANE			46									45.8	46					
3,3-DIMETHYLPENTANE																		
CYCLOHEXANE								8				7.7	8					
2,3-DIMETHYLPENTANE			1							1		1.1	1			1	1.1	1
2-METHYLHEXANE			2		2		3	3	4		6	3.3	6	1			1.3	1
CYCLOHEXENE															4		3.8	4
3-METHYLHEXANE	1		2	1	2	2	2	2	2	1	3	1.9	3	2		3	2.2	3
2,2,4-TRIMETHYLPENTANE							1	1	2		2	1.6	2	2			1.5	2
HEPTANE	1		2	1	2	2	2	2	2	1	2	1.8	2	1		2	1.7	2
METHYLCYCLOHEXANE			1					1	1	1	1	1.2	1			1	1.2	1
2,5-DIMETHYLHEXANE																		
1-CHLOROPENTANE																		
2,3,4-TRIMETHYLPENTANE										1	1	1.1	1			1	1.3	1
TOLUENE	11	22	116	77	91	104	103	125	71	23	29	70.3	125	8		17	12.4	17
3-METHYLHEPTANE	1		1		1	1	1	2	2	1	2	1.5	2			1	1.2	1
4-METHYLHEPTANE											1	1.3	1					
c-1,3-DIMETHYLCYCLOHEXANE							1	2	2		2	1.9	2					
3-METHYLHEPTANE							1	2	3		2	2.1	3					

Table 9 ctd.

Hamilton '87 : VOC Sampling Results

Domtar (Cassidy Works) tar plant

Monitoring Period	B132	B132	B142	B142	B142	B142	A152	A152	A152	B153	A192			B152	A153	B192		
Sampling Site Information	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR			u-DR	u-DR	u-DR		
Sampling Date	OCT 13	OCT 13	OCT 14	OCT 14	OCT 14	OCT 14	OCT 15	OCT 15	OCT 15	OCT 15	OCT 19			OCT 15	OCT 15	OCT 19		
Sample Start Time	13:25	14:36	10:20	11:43	13:30	14:45	11:35	13:00	14:30	16:05	14:30	Downwind		11:40	16:00	14:34	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound																		
1,1-DIMETHYLCYCLOHEXANE																		
trans12DIMETHYLCYCLOHEXAN																		
TETRACHLOROETHENE			5									5.3	5					
c-1,4-DIMETHYLCYCLOHEXANE																		
OCTANE	1		1				2	3	2	1	1	1.6	3			1	1.2	1
trans-2-OCTENE																		
ETHYLCYCLOHEXANE																		
1-CHLOROHEXANE																		
ETHYLBENZENE	3	3	39	27	36	42	34	43	33	3	10	24.8	43	2	3	3	2.6	3
M,P-XYLENE	8	9	78	44	61	74	66	73	47	12	29	45.5	78	5	8	10	7.8	10
4-METHYLOCTANE							3					3.4	3					
2-METHYLOCTANE																		
3-METHYLOCTANE							1					1.0	1					
STYRENE							19	23		1		14.5	23					
1,4-DICHLOROBUTANE			7									6.8	7					
o-XYLENE	3	3	29	16	21	25	22	24	17	4	7	15.4	29	2	4	4	3.0	4
1-NONENE			2									1.7	2					
trans-1,4-DICL-2-BUTENE																		
NONANE	1		7	1	3	4	4	4	3		1	3.1	7		1	2	1.5	2
ISOPROPYLBENZENE						3	3	3	2			2.8	3					

Table 9 ctd.

Hamilton '87 : VOC Sampling Results

Domtar (Cassidy Works) tar plant

Monitoring Period	B132	B132	B142	B142	B142	B142	A152	A152	A152	B153	A192			B152	A153	B192		
Sampling Site Information	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR			u-DR	u-DR	u-DR		
Sampling Date	OCT 13	OCT 13	OCT 14	OCT 14	OCT 14	OCT 14	OCT 15	OCT 15	OCT 15	OCT 15	OCT 19			OCT 15	OCT 15	OCT 19		
Sample Start Time	13:25	14:36	10:20	11:43	13:30	14:45	11:35	13:00	14:30	16:05	14:30	Downwind		11:40	16:00	14:34	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound																		
PROPYLBENZENE					2	2						2.1	2			1	1.1	1
3-ETHYLTOLUENE	1	2	18	5	14	14				3	1	7.2	18	1		2	1.6	2
4-ETHYLTOLUENE			10		8	9						9.0	10		1		1.2	1
1,3,5-TRIMETHYLBENZENE	1	1	18		13	14				1	3	7.3	18			1	1.1	1
2-ETHYLTOLUENE			3	2	2	3					1	2.4	3			1	1.1	1
tert.BUTYLBENZENE	1			6							5	3.9	6					
1,2,4-TRIMETHYLBENZENE	4	4	31	17	23	25				3		15.0	31	2		3	2.5	3
sec.BUTYLBENZENE																		
DECANE	2	2	11	3	5	6	6	8	6	1	7	5.2	11	1	3	3	2.4	3
1,2,3-TRIMETHYLBENZENE	1	1	8	5	6	6				1	4	4.0	8			1	1.1	1
1,2-DICHLOROBENZENE				2			3	3	2			2.4	3					
INDAN		4	108	77	114	116	333	384	227	3	41	140.8	384					
BUTYLCYCLOHEXANE			3									2.9	3					
BUTYLBENZENE			5	2						1		2.6	5					
UNDECANE	3	2	7	3	3	4	10	6	3	2		4.3	10	1	1	2	1.5	2
1235-TETRAMETHYLBENZENE			2		1	2						1.6	2					
1234-TETRAMETHYLBENZENE			2									2.0	2					
NAPHTHALENE		7	55	54	53	61	10	16	8	10	1	27.5	61					
DODECANE	3	2	4	3	3	3	9	6		2		3.8	9			1	1.3	1

Table 9 ctd.

Hamilton '87 : VOC Sampling Results

Domtar (Cassidy Works) tar plant

Monitoring Period	B132	B132	B142	B142	B142	B142	A152	A152	A152	B153	A192			B152	A153	B192		
Sampling Site Information	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR	d-DR			u-DR	u-DR	u-DR		
Sampling Date	OCT 13	OCT 13	OCT 14	OCT 14	OCT 14	OCT 14	OCT 15	OCT 15	OCT 15	OCT 15	OCT 19			OCT 15	OCT 15	OCT 19		
Sample Start Time	13:25	14:36	10:20	11:43	13:30	14:45	11:35	13:00	14:30	16:05	14:30	Downwind		11:40	16:00	14:34	Upwind	
Sample Duration	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound																		
Total Compounds Identified	29	22	45	34	37	36	34	34	33	38	30	34	45	26	14	40	27	40
Total Organic Conc. (ug/m3)	109	228	952	591	721	844	936	1119	705	164	261	602.8	1119	112	76	286	131.5	286
Alkanes (ug/m3)	56	119	115	59	75	82	101	111	106	63	127	92.3	127	81	55	131	89.1	131
Cycloalkanes (ug/m3)	1	0	7	2	3	3	3	13	7	4	3	4.2	13	3	2	5	3.2	5
Alkenes (ug/m3)	2	0	6	3	4	2	0	0	0	3	0	1.7	6	3	0	10	4.1	10
Cycloalkenes (ug/m3)	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	4	0	1.3	4
Alkynes (ug/m3)	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0.0	0
Aromatics (ug/m3)	47	109	766	522	639	729	829	990	560	93	131	492.2	990	25	16	56	32.5	56
Chlorinated Alkanes (ug/m3)	3	0	53	3	0	28	0	0	30	2	0	10.7	53	0	0	4	1.2	4
Chlorinated Alkenes (ug/m3)	0	0	5	0	0	0	0	0	0	0	0	0.5	5	0	0	0	0.0	0
Chlorinated Aromatics (ug/m3)	0	0	0	2	0	0	4	4	2	0	0	1.1	4	0	0	0	0.0	0

Table 10

Hamilton '87 : VOC Sampling Results

	Stelco steel mill				General Air Quality						
Monitoring Period	A203	A203		A213	B282	A163	A164	B162	B163		
Sampling Site Information	d-SL	d-SL		Upwind	aq & on	aq&d-V	aq & IV	aq	aq		
Sampling Date	OCT 20	OCT 20		OCT 21	SEP 28	OCT 16	OCT 16	OCT 16	OCT 16		
Sample Start Time	12:05	13:30	Downwind	12:20	15:43	11:00	14:02	11:09	15:00		
Sample Duration	0.5-hr	0.5-hr	Averages	0.5-hr	0.5-hr	1.0-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound											
PROPANE	7	4	5.6	26	10	40	34	34	15	26.8	40
2-METHYLPROPANE				12	4	18	24	22	19	17.3	24
1-BUTENE								3	6	4.5	6
BUTANE	29	6	17.0	47	11	54	78	48	64	50.9	78
2-METHYLBUTANE	24	7	15.8	43	7	33	55	32	51	35.7	55
2-METHYL-1-BUTENE									5	4.6	5
PENTANE	17	5	11.2	34	5	24	41	20	28	23.7	41
2-METHYL-1,3-BUTADIENE											
trans-2-PENTENE				8				2	5	3.5	5
cis-2-PENTENE									3	2.8	3
DICHLOROMETHANE				9				11	6	8.8	11
2-METHYL-2-BUTENE				11				1	7	3.9	7
2,2-DIMETHYLBUTANE				3			3	2	3	2.5	3
CYCLOPENTANE	2		1.5	4		2	4	2	3	2.9	4
2,3-DIMETHYLBUTANE	2		1.6	5		3	5	3	5	4.0	5
2-METHYLPENTANE	7	4	5.8	24	3	14	25	14	19	14.9	25
3-METHYLPENTANE	6	3	4.3	15	2	10	16	10	11	9.9	16
HEXANE	7	5	5.9	21	3	19	25	19	16	16.3	25
METHYLCYCLOPENTANE				8		6	8	4	5	5.8	8
2,4-DIMETHYLPENTANE								2	2	2.0	2

Table 10 ctd.

Hamilton '87 : VOC Sampling Results

	Stelco steel mill				General Air Quality						
Monitoring Period	A203	A203		A213	B282	A163	A164	B162	B163		
Sampling Site Information	d-SL	d-SL		Upwind	aq & on	aq&d-V	aq & IV	aq	aq		
Sampling Date	OCT 20	OCT 20		OCT 21	SEP 28	OCT 16	OCT 16	OCT 16	OCT 16		
Sample Start Time	12:05	13:30	Downwind	12:20	15:43	11:00	14:02	11:09	15:00		
Sample Duration	0.5-hr	0.5-hr	Averages	0.5-hr	0.5-hr	1.0-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound											
1,1,1-TRICHLOROETHANE				16		3	7	15	7	8.2	15
BENZENE	13		12.9	33	8	14	23	32	18	18.9	32
TETRACHLOROMETHANE									14	13.8	14
3,3-DIMETHYLPENTANE									2	1.6	2
CYCLOHEXANE				2		4	2	2	1	2.5	4
2,3-DIMETHYLPENTANE						9		3	3	4.9	9
2-METHYLHEXANE	4	2	3.3	14		9	13		6	9.6	13
CYCLOHEXENE											
3-METHYLHEXANE	2	1	1.7	8		6	8	6	7	6.7	8
2,2,4-TRIMETHYLPENTANE	2		1.7	6		5	8		6	6.3	8
HEPTANE	2	1	1.5	6	1	7	9	7	5	5.9	9
METHYLCYCLOHEXANE				3		6	5	6	4	5.3	6
2,5-DIMETHYLHEXANE				1		1	1			1.3	1
1-CHLOROPENTANE								2	1	1.4	2
2,3,4-TRIMETHYLPENTANE				3		2	3	3	3	2.6	3
TOLUENE		18	17.9	42	19	43	82	58	35	47.3	82
2-METHYLHEPTANE				3		4	9	3	2	4.8	9
4-METHYLHEPTANE				1		4	8		1	4.0	8
c-1,3-DIMETHYLCYCLOHEXANE				4		5	4	2	1	3.0	5
3-METHYLHEPTANE				5		6	8	3		5.6	8

Table 10 ctd.

Hamilton '87 : VOC Sampling Results

	Stelco steel mill				General Air Quality						
Monitoring Period	A203	A203		A213	B282	A163	A164	B162	B163		
Sampling Site Information	d-SL	d-SL		Upwind	aq & on	aq&d-V	aq & IV	aq	aq		
Sampling Date	OCT 20	OCT 20		OCT 21	SEP 28	OCT 16	OCT 16	OCT 16	OCT 16		
Sample Start Time	12:05	13:30	Downwind	12:20	15:43	11:00	14:02	11:09	15:00		
Sample Duration	0.5-hr	0.5-hr	Averages	0.5-hr	0.5-hr	1.0-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound											
1,1-DIMETHYLCYCLOHEXANE											
trans12DIMETHYLCYCLOHEXAN											
TETRACHLOROETHENE				10		3	15	7	5	7.5	15
c-1,4-DIMETHYLCYCLOHEXANE				1		3	1			2.0	3
OCTANE				3	2	4	5	4	3	3.7	5
trans-2-OCTENE											
ETHYLCYCLOHEXANE						1	2	1		1.3	2
1-CHLOROHEXANE											
ETHYLBENZENE		2	1.9	9	5	7	13	8	5	7.9	13
M,P-XYLENE		6	6.5	36	18	22	37	24	14	23.1	37
4-METHYLOCTANE								2	1	1.5	2
2-METHYLOCTANE								1	1	1.3	1
3-METHYLOCTANE		9	8.6	3		2				2.2	2
STYRENE											
1,4-DICHLOROBUTANE								2		2.1	2
o-XYLENE		3	2.9	12	6	6	11	9	6	7.4	11
1-NONENE								1		1.0	1
trans-1,4-DICL-2-BUTENE											
NONANE	2		1.9	3	2	2	2	3	2	2.3	3
ISOPROPYLBENZENE											

Table 10 ctd.

Hamilton '87 : VOC Sampling Results

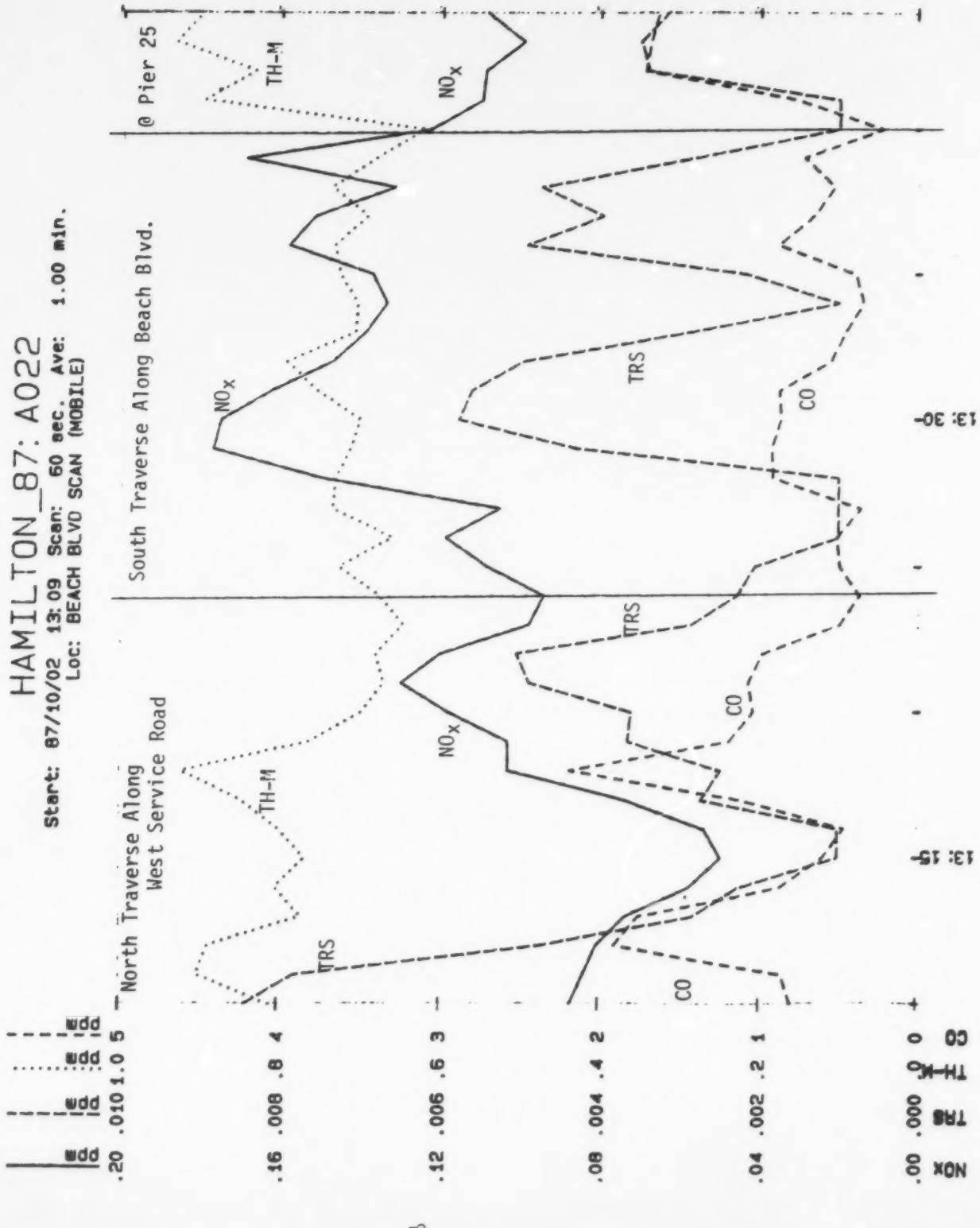
	Stelco steel mill				General Air Quality						
Monitoring Period	A203	A203		A213	B282	A163	A164	B162	B163		
Sampling Site Information	d-SL	d-SL		Upwind	aq & on	aq&d-V	aq & IV	aq	aq		
Sampling Date	OCT 20	OCT 20		OCT 21	SEP 28	OCT 16	OCT 16	OCT 16	OCT 16		
Sample Start Time	12:05	13:30	Downwind	12:20	15:43	11:00	14:02	11:09	15:00		
Sample Duration	0.5-hr	0.5-hr	Averages	0.5-hr	0.5-hr	1.0-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound											
PROPYLBENZENE							2	2	1	1.9	2
3-ETHYLTOLUENE				5	1	2	5	4	2	2.7	5
4-ETHYLTOLUENE				8			6			5.5	6
1,3,5-TRIMETHYLBENZENE				11		4	5	2	1	3.0	5
2-ETHYLTOLUENE				5		2	2	2	1	1.8	2
tert.BUTYLBENZENE							6		1	3.8	6
1,2,4-TRIMETHYLBENZENE					2			5	3	3.4	5
sec.BUTYLBENZENE											
DECANE	2		1.8	6	5	6	5	4	2	4.6	6
1,2,3-TRIMETHYLBENZENE								2	1	1.5	2
1,2-DICHLOROBENZENE								2		1.9	2
INDAN				2							
BUTYLCYCLOHEXANE						1		1		1.2	1
BUTYLBENZENE								2		1.6	2
UNDECANE				1	10		2	3		4.9	10
1235-TETRAMETHYLBENZENE											
1234-TETRAMETHYLBENZENE											
NAPHTHALENE								2		1.7	2
DODECANE					8			2		4.7	8

Table 10 ctd.

Hamilton '87 : VOC Sampling Results

	Stelco steel mill				General Air Quality						
Monitoring Period	A203	A203		A213	B282	A163	A164	B162	B163		
Sampling Site Information	d-SL	d-SL		Upwind	aq & on	aq&d-V	aq & IV	aq	aq		
Sampling Date	OCT 20	OCT 20		OCT 21	SEP 28	OCT 16	OCT 16	OCT 16	OCT 16		
Sample Start Time	12:05	13:30	Downwind	12:20	15:43	11:00	14:02	11:09	15:00		
Sample Duration	0.5-hr	0.5-hr	Averages	0.5-hr	0.5-hr	1.0-hr	0.5-hr	0.5-hr	0.5-hr	Averages	Maximum
Compound											
Total Compounds Identified	16	15	15.5	47	21	41	43	54	52	42	54
Total Organic Conc. (ug/m3)	127	76	101.7	546	130	417	627	467	441	416.5	627
Alkanes (ug/m3)	113	47	79.9	294	71	283	388	250	278	254.1	388
Cycloalkanes (ug/m3)	2	0	0.8	22	0	28	26	20	14	17.7	28
Alkenes (ug/m3)	0	0	0.0	26	0	0	0	7	25	6.4	25
Cycloalkenes (ug/m3)	0	0	0.0	0	0	0	0	0	0	0.0	0
Alkynes (ug/m3)	0	0	0.0	0	0	0	0	0	0	0.0	0
Aromatics (ug/m3)	13	29	21.0	168	59	100	191	151	90	118.0	191
Chlorinated Alkanes (ug/m3)	0	0	0.0	25	0	3	7	31	28	13.9	31
Chlorinated Alkenes (ug/m3)	0	0	0.0	10	0	3	15	7	5	6.0	15
Chlorinated Aromatics (ug/m3)	0	0	0.0	0	0	0	0	2	0	0.4	2

Figure 2


HAMILTON_87: A022
Start: 87/10/02 13:09 Scan: 60 sec. Ave: 1.00 min.
Loc: BEACH BLVD SCAN (MOBILE)
North Traverse Along West Service Road
South Traverse Along Beach Blvd.
@ Pier 25
TH-M
NOx
TRS
CO
13: 15
13: 30
NOx .00 .04 .08 .12 .16 .20
TRS .000 .002 .004 .006 .008 .010
TH-M 0 .2 .4 .6 .8 1.0
CO 0 1 2 3 4 5